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Electrical World

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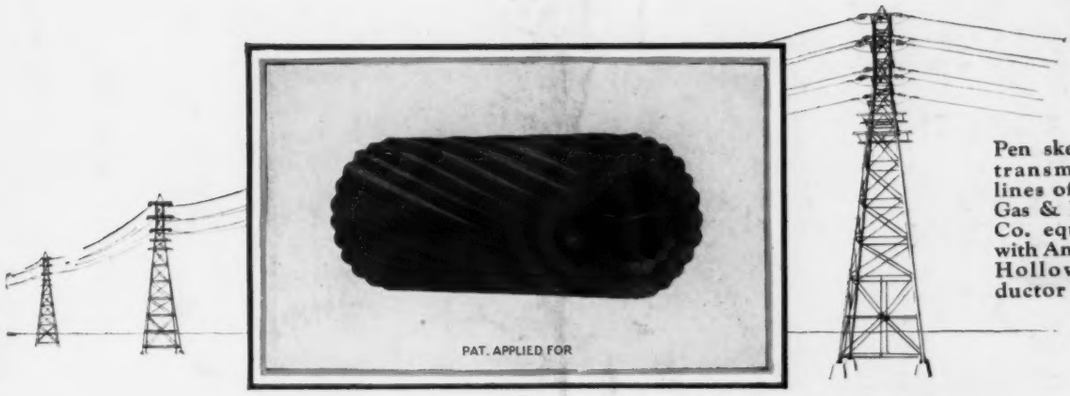

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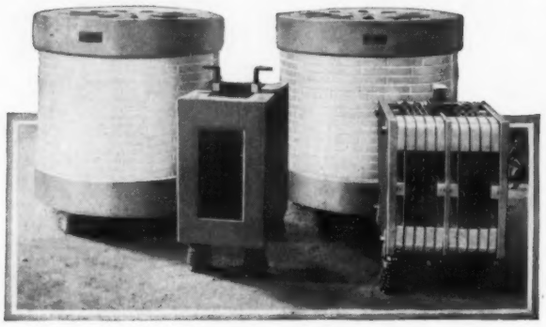

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Electrical World

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W. H. ONKEN, JR.
Editor

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Muscle Shoals Controversy Nearing Solution

GRANTED in any particular case the possession of facts and time to present them, normally there can be but one outcome. It matters not how expert the adversary or how glib of tongue the special pleader, facts, however much they may be temporarily smothered, will eventually prevail. Muscle Shoals, for example, has long been in the public eye. Volumes have been printed and millions of words uttered about that water-power development in the South, which without government investment might have remained an obscure spot in Alabama. Most of the material issued about Muscle Shoals has been buncombe, and naturally such statements could not stand the test of time. There never was any question as to who could best distribute Muscle Shoals power and benefit the South most, although politicians, real estate operators and others have managed for years to becloud the issue. Nor could the government after it adopted a definite water-power policy refuse with any grace to adhere to it. Therefore, when the special committee appointed by Congress to solicit bids for the government property at Muscle Shoals reported this week in favor of the bid of the associated power companies, it occasioned no surprise to those conversant with the facts.

This, of course, does not mean that Muscle Shoals is finally disposed of. Would that it did! Congress may again debate over the property, notwithstanding the recommendation of the joint committee and the fact that the offer of the associated power companies does not entail additional appropriations by the United States. But, deliberate and slow-moving as Congress is, it may be that it has had enough of Muscle Shoals as a political football and, like the administration, will be glad to welcome a settlement on business lines. It will, however, be a red-letter day in the South when the hydro-electric development at Muscle Shoals is interconnected with the other systems of Alabama, Tennessee and Georgia and performs its proper function of supplying needed energy to the industries and people of that section and helping them to maintain their place in the sun.

Low-Voltage Protection of Motors

RELIABLE and continuous service is demanded from motors in industry. Mass production is the practice today and no cessation of motor operation can occur without loss in production. One of the sources of trouble of this kind arises from the fact that dips in voltage of the local or utility power supply may cause an induction motor to stop through the operation of its low-voltage release.

As a result there can be found advocates of removing low-voltage protection from motor starters or of putting a time delay on the low-voltage releases. In the power stations of the utilities, where skilled operators are employed and continuous operation of auxiliaries is essential, many motors are used without low-voltage releases; but in general industry different conditions exist. Safety to life and limb must be considered, the skill of operators must be weighed, the vast variety of motors and their applications must be measured. In this light it would seem best to go slowly in the elimination of low-voltage protection, but it would seem very feasible to develop a line of time-delay releases which could be utilized intelligently for some applications where instantaneous releases would not be warranted. Even this step, however, would require that engineering methods must be applied to each application, and the future use of the motor and starter on other work would have to be considered. In a large industrial plant with a competent engineering staff these conditions could be met, but for a very large number of applications even a time-delay, low-voltage protection device would have to be considered carefully. Moreover, state, city and utility safety and wiring rules must be met, and even though they differ widely, they now generally prescribe low-voltage protection.

No general elimination or change would seem to be warranted, therefore, but the manufacturers might well develop time-delay equipments for use where they are intelligently applied. This would add a beneficial element to electric service for many applications.

Richmond Station Beautiful and Well Designed

IN THIS issue is published a series of articles on the new Richmond station of the Philadelphia Electric Company. This large power unit is treated at length because it is a representative modern station, because it requires several articles to discuss its features adequately and because it embodies several new yet conservative departures in station practice. This power plant was produced by a well-balanced utility engineering organization after very careful studies had been made to assure a station that would fit into system plans most effectively and most economically. The striking physical aspects of the station lie in its architecture, its spaciousness and its standardization on a simple layout with uniform types and ratings of equipment.

It is a beautiful station from any view and embodies architectural features which should make it an object of pride to the city of Philadelphia and to the employees of the utility. Beauty in a power station has been considered by many American designers either too expensive or unnecessary. If it can be obtained at a reasonable cost, it is well worth the money spent, not only because it improves public relations, but also because it produces an environment for station employees conducive to obtaining the best operating performance. In Richmond the attractive and unusual dome over the turbine hall has also great utility. It gives a window area, a ceiling volume and ventilating possibilities

which are greatly appreciated during normal operations and would be of much service in the event of trouble with the generating units. The station design as a whole is conservative yet embodies several new and approved equipments such as air preheating and stage bleeding. Nor have the designers hesitated in using a new type of water wall in the boilers and a phase-isolated switch house, even though these are departures from past practices on this property. Operating experiences to date are very satisfactory, and the utility officials are well pleased with the results obtained.

Above all things, Richmond should be easy and simple to operate. Space arrangements are very ample, the natural lighting is splendid, and each generating unit is a complete miniature plant and a duplicate of all the others. As stated in the article by Mr. Funk, any station is built to be operated, and features of design must be carefully weighed against practical operating possibilities. In this respect Richmond has merited the commendation of all who have visited it. It has many other features which can be studied with profit by all those interested in modern power stations.

Why Not One International Standards Commission?

WHEN the International Electrotechnical Commission held its plenary meeting in New York City the International Standardization Conference, with which the American Engineering Standards Committee is affiliated, had its sessions at the same place. In addition to these two international engineering bodies, there is also the International Commission on Illumination. With the growth of international engineering activities the probabilities are that the number of such commissions and the importance of the problems to be considered by each will steadily increase. This may lead to some overlapping of activities, difficulties in scheduling meetings, contradictory rulings, claims about lack of jurisdiction, etc. The question therefore arises, why not have one comprehensive international technical or standards commission to deal with all kinds of engineering problems? Such a commission would have to be large, but it could consist of several sections, each split into divisions, the divisions working independently and their recommendations submitted to the respective sections. These recommendations would be uniformly codified there and submitted for final approval at plenary meetings of the commission proper. Since problems for consideration would originate from the high commission and the norms decided upon be finally passed by it, there could be no overlapping of authority, no contradictory decisions and no duplication of work.

There may be difficulties in the way of formation of such a comprehensive commission, but the success of the present International Electrotechnical Commission, with twenty years of enviable record, speaks for the feasibility of a similar larger body. In fact, the organization, the principles of procedure, the established precedents, the spirit of international good will and other assets accumulated by this commission would suggest merely dropping the word "Electro" from its name and making it the International Technical or Standards Commission. This would simply mean adding new sections on illumination, machine parts, radio and other subjects as the need arises. It is sincerely to be hoped that such a change may be effected as soon as possible and before the situation becomes more entangled. Some features of the standardization work of any such commission would undoubtedly be hampered by the two systems of units of weights and measures in use, but this simply would be another argument in favor of the adoption of the rational decimal metric system by the English-speaking peoples.

Domestic Load and the Lesson of the Factory

IT IS a fair statement to say that the electrical industry has so far developed about 44 per cent of the power load available in shops, mills and factories accessible to existing distribution lines. How has this been accomplished? Factory superintendents did not welcome the electric motor with a glad cry. They were not particularly interested in the central-station man's ambition to build up an off-peak power load, nor did they share his enthusiasm for this new, ingenious electrical device. And so the power company soon found that motors could not be sold, for example, as electric signs had been sold, by the forces of promotion only and by an appeal to the competitive instinct that impels one man to follow another's lead. It soon developed that the only way to sell motors was actually to send capable engineers into factories to study seriously each individual manufacturer's production problem and find out what economies could be effected in that particular plant by electrical equipment over the cost of other methods in use.

It was a great innovation in central-station practice, but it worked, and by this method the electric motor has been established as the standard power in industry. The result today is a consumption of billions of kilowatt-hours annually. In short, the central-station man forgot himself and went out and concentrated on the intimate problems of his customer. He rendered that customer an invaluable personal service, and it has been a fine construction achievement and a profitable one.

Meanwhile, what of the domestic market? It is again a safe estimate that the electrical industry has so far developed less than 7 per cent of the domestic market, having in mind all the applications of electricity now practical for the modern home and all the homes now accessible to power lines. Forty-four per cent in industry, 7 per cent in the home—and the household was the first market approached! Why should this disparity exist?

As a matter of fact, frankly admitted, the central-station industry has never actually made serious, intelligent effort to develop the domestic market. It tried to sell to the factory the way it sells to the home and failed. Then it settled down to study the factory man's job, and he saw that the electrical man was rendering him a service and responded gladly. When will the industry begin in the same spirit to study the job of the woman in the home?

Since the beginning the electrical industry has approached John and Mary, who represent the great domestic market for electrical service, as a man stalks a pair of horses in a pasture, holding out a hatful of oats. The salesman goes to the prospective customers' front door with a winning smile and says: "See the nice vacuum cleaner! Don't you want to own one?" Time and time again he goes, on each occasion with some other individual article of electrical hardware. And why? Because electrical men have decided that

they desire to sell that particular article to everybody at that time. Whether Mary needs and wants just that appliance then, and whether every Mary should be buying it, they have not stopped to study and find out. They simply believe in all these appliances themselves. They are confident that they are needed in the home. They let it go at that and send out their men to sell. Why can they not remember the lesson of the factory?

The time has come to study Mary's job and help her to find a way to meet the economic problem that besets the American home today. Asking her to buy single appliances is not satisfying her. It is an entirely superficial approach. What John and Mary want to know is whether complete electrical equipment, intelligently organized into the operation of their home, will meet the new conditions that have come with modern times. And when the power company goes about the job that way, the residence load will come.

Trend Toward Distribution Networks

THE alternating-current distribution network has made rapid strides in many cities where load densities have increased. It is the best available system, from the standpoint of economics and service, for using alternating-current mains to supply the variety of loads encountered in metropolitan areas. It also requires a minimum addition to capital investment and a minimum change in physical layouts to meet increased service demands.

This new system should be viewed in the light of historical developments and adopted in the light of future service requirements. In the early days the direct-current network was the accepted service for the heavy general-load areas. Then came the era of power, and efforts were concentrated on servicing all industry through rather high-voltage, three-phase alternating-current circuits. This was considered to be the most economical system, and power loads so predominated that this circuit fixed generation, transmission and primary distribution. Little attention was paid to residential and general commercial service during this period, and the three-phase and single-phase secondary systems were the most expedient systems to use to supply this load. Thus power requirements fixed the standards and the economics of the major electrical systems.

But general loads in cities have increased greatly, and in addition there is a desire because of economic and standardization reasons to replace or to limit the extension of direct-current networks by the use of a universal alternating-current service. It is realized that load developments require the growth of a very strong secondary system which can be extended, which is universal in its application to service demands, which is capable of maintaining the best service at a minimum cost and which can be utilized to serve all new loads with a minimum of metering, construction and investments.

After much debate the system most favored is the three-phase, four-wire alternating-current network for the supply of light, power or the combination of light and power. But, unfortunately, most services and equipments are 110 volts or 220 volts today, and the electrical relations in the three-phase circuit make it possible only to obtain service at either 115 and 199 volts or 120 and 208 volts with simple transformation ratios. The relative merits of these combinations have been debated thoroughly and especially their effects on service using present standard equipment. No unanimous decision has been reached and both types of networks are in service. Both systems give satisfactory service when standard equipment is used, for, fortunately, lamps may be had at either 115 or 120 volts and single-phase and polyphase motors have tolerances whereby satisfactory operation may be had between, roughly, 110 and 120 volts single-phase and 200 and 240 volts three-phase. But, of course, when operated at points near the tolerance limits the margins of departure from the average motor characteristics are changed, and a design based on either system as a standard would have a wider field of satisfactory application.

It is to be hoped, therefore, that those using alternating-current networks will soon come to an agreement on the voltages to be used. These networks are here to stay and will extend rapidly as commercial efforts continue to intensify the service to each customer. The future should see a secondary grid to supply all service to a community as this makes for maximum economy once the load density is sufficient to support the investment. In the meantime any standard equipment can be utilized on the network with satisfactory results, and this network system is not of such magnitude as to warrant departures from present designs. The goal should be to agree upon standard network voltages and, as this system increases, then gradually design equipments for best possible operation on the circuits. Opinions differ and arguments are good for either system of voltage, but the 120-volt and 208-volt system has the inherent advantage of giving greater ultimate economy because of its higher voltage values.

Catching Complaints at Their Source

A WELL-OPERATED utility company seeks to eliminate all complaints. When a customer becomes so courageous or so angry as to complain to the company it may be taken for granted that he has first told his troubles to all his friends and associates and that after the complaint has been handled he will feel either victorious and crow or disgruntled and "crab." Any complaint that reaches the utility officials makes for bad public relations, no matter how ably it may be handled.

There are many ways of catching troubles before they reach the acute form of a complaint. One of the best means, especially with power customers, is to have an able, intelligent and well-manned power sales or industrial relations staff. These men, if competent, can do many things to make for better service to customers. They can visit power customers and become personally acquainted. They can help the power customers with their power problems. They can explain rates and company policies to these customers and gradually build up a feeling of friendship and confidence in their minds. Power salesmen should also scrutinize all customer bills promptly and note changes or mistakes immediately so that they can reach the customer to correct or to explain before he begins to simmer from annoyance based perhaps on misunderstanding.

This kind of work is not spectacular, but it is effective and necessary. It is part of intelligent utility service and pays dividends. A utility can well afford to get the best possible men and support them in this quiet and effective public relations work. If any utility has friendly instead of belligerent power customers, it is largely due to the personal efforts of able power salesmen, and this fact should not be forgotten by executives.

Charles Henry Tenney

A master builder of public utilities. His humanity equals his business acumen and a loyal organization vouches for his executive qualities. Service to the public and to his employees has a real meaning in his mind.

CONSPICUOUS leadership has been responsible for the progress of the public utility industry from pioneer days to the present hour. Specialists have made invaluable contributions to the service of the public, but all through the years executives of broad vision, penetrating insight, constructive imagination, vigorous energy and sound judgment have been vitally necessary to inspire, direct and co-ordinate the work of their organizations, building great enterprises out of small beginnings and enriching the civilization of their time literally beyond measure.

Such an executive is Colonel Charles H. Tenney, founder and chairman of the board of the Boston house bearing his name. Born at Chelsea, Mass., 57 years ago, his early business training was in investment banking. Here he "licked stamps," kept books, sold bonds to farmers, planned and negotiated as a partner, and in 1900 Charles H. Tenney & Company entered the public utility field by taking over the management of the Malden (Mass.) Electric Company, the pioneer central station of a utility group now representing nearly one hundred millions of invested capital, serving the public through properties in half a dozen states, and affiliated with a financing, operating and engineering organization of the first rank whose slogan, "Tenney service," has come to express all that is best in public relations, progressive sales activity, technical and administrative skill. Ably assisted by his brother, Albert B. Tenney, and an increasing group of associates and staff members who honor the Tenney ideals by their practice, "the Colonel" makes time to serve many other public and business interests and is a quiet but valued counselor in electrical inner circles. A long list of directorships carries his name, and he was chief of finance of the Ordnance Department during the war, served overseas at Tours and Paris, and received the distinguished service medal in 1923.

Like many other influential men of the electrical industry, Colonel Tenney has won the devoted loyalty of his fellow workers through his appreciation of the human side of its development and his recognition of ability wherever revealed. The Tenney organization is a living monument to this distinguished citizen of the electrical world, whose career illustrates again the inclusiveness of the industry in opportunity for success through service.

System Aspects of Richmond Station

Essentials for Proper Station Location Stated—Reliability, High Efficiency and Low First Cost Primary Goals—Advantages of the Sectional Building Plan Outlined

By Dr. W. C. L. EGLIN
Vice-President and Chief Engineer Philadelphia Electric Company

TURBINE HALL, SHOWING NO. 10 TURBO-GENERATOR (50,000 KW.) AND 70,000-SQ.FT. WHEELER CONDENSER

IN THE STUDIES leading up to the selection of the site and the general plan for a new large generating station certain essentials must be considered in regard to each alternative.

Most fundamental is the need for a supply of good water for condensing purposes, with sufficient flow to maintain reasonably low temperatures during the hot season. By this requirement the choice of sites is usually restricted to those lying along the shore of some considerable body of water (sea, lake or large river).

The station must be accessible by all the modes of traffic necessary for the delivery of materials and equipment, and for the transportation of the forces engaged in construction and operation.

Sufficient ground area should be included to accommodate all of the buildings in the ultimate plant as initially projected, with coal-storage facilities, and, if high-voltage transmission is planned, an outdoor substation, and also to allow space for future developments, many of which cannot immediately be foreseen.

Neighboring properties should introduce no conditions dangerous or injurious to equipment or men—for instance, fire hazard, emission of corrosive fumes or interference with natural lighting and ventilation.

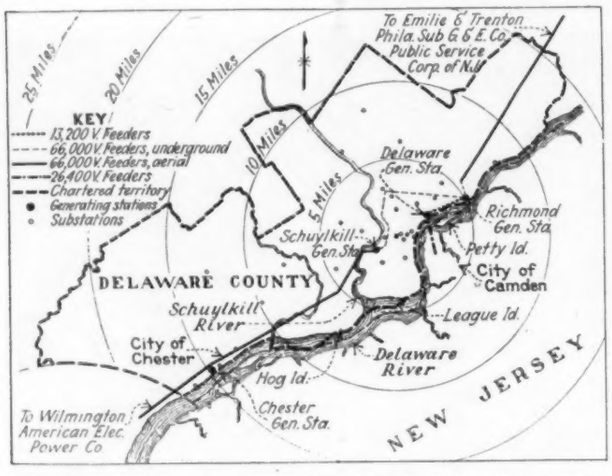
Geographically, the station should stand in a well-balanced relation to the distribution system, both as it exists and as it is forecast to grow, so that excessive investment and operating charges shall not be incurred in the transmission of the delivered energy. Its posi-

tion should also be favorable for interconnection with other stations, whether of the same system or of outside companies.

The character and load factor of the load to be assigned to the station must also be considered.

The general plan should provide for construction in units, small relative to the ultimate station capacity, with a minimum of idle investment.

The three objectives of good operation—reliability, high efficiency and low first cost—are interrelated in the sense that the application of a high standard of reliability cannot fail to raise the first cost, and in a



RICHMOND STATION LOCATION WITH RESPECT TO THE SYSTEM OF THE PHILADELPHIA ELECTRIC COMPANY

lesser degree the operating cost, above the lowest possible value. The most suitable plan, of course, all of the other requirements having been met, is that in which the sum of the investment and operating charges is a minimum.

PLACE OF RICHMOND IN SYSTEM

The Richmond station well exemplifies in its location and design the result of careful balancing of all the foregoing considerations. The accompanying map of Philadelphia and vicinity, with the generating stations and substations of the Philadelphia Electric Company system marked, indicates that Richmond station is located in the northeastern section of Philadelphia on the Delaware River. The Delaware is one of the great rivers of the Atlantic coast, with a deep water channel extending some distance above the station. The river is tidal at this point, so that water heated by circulating through the condenser is carried away even more actively than if dependence were placed upon the flow of the river. No contamination of the water that would make it unsuitable for condensing purposes is experienced.

The station is particularly accessible, by water, to its regular and emergency sources of fuel supply. Immediately up stream from the station is the bridge of the Pennsylvania Railroad Seashore Line. Above this bridge it is not uncommon for the river to be frozen for several days in the severe winter weather, whereas below it navigation is practically continuous throughout the year.

Coal, ordinarily received from the Port Richmond piers of the Reading railway, will be drawn from the principal coal-storage point of the Philadelphia Electric Company at Petty's Island in the event of a cessation of either mining or transportation so prolonged as to exhaust the local storage. The distance from Richmond station either to Port Richmond or to Petty's Island is about two miles.

For rail delivery of equipment and supplies, the Kensington and Tacony branch of the Pennsylvania Railroad passes the property on the west. The station is sufficiently well served by transit facilities that no difficulty has been experienced by the construction or operating forces in reaching the site.

About 31.4 acres of ground has been set aside for the generating station and all structures directly associated with it, with a neighboring but not directly adjacent plot of 32.5 acres for coal storage. These areas appear at the present time ample for all expected calls for space.

The Pennsylvania Railroad borders the station property on the north, the Delaware River on the east; to the west and south is property owned by the city of Philadelphia in which filter beds are being installed. The character of the adjacent property is thus seen to be such as to promise a minimum of hazard or interference.

The station can serve directly a load area already heavy and rapidly growing. Interconnection with the other stations of this company and with the neighboring companies is readily practicable.

NOT A BASE LOAD STATION

Richmond has not been constructed to operate as a base load station. The heavy additional investment in transmission that would be required to load the station at other than peak periods would not be justified by the savings to be secured. Of course, Richmond is favored slightly in load factor over the older stations, but only by so much as the transmission capacity necessary to protect against failure of a unit will permit.

In the general plan of the station reliability has been secured by the adoption of the completely separate sectional type of building construction and by limiting the size and type of main units to a reasonable advance over successful previous experience. The sectional construction also tends to reduce the amount of idle investment at any time prior to the completion of the station, although it is recognized that it does increase slightly the ultimate cost. The gain in reliability far outweighs this small increase.

In the decision as to the pressure to be adopted the question of reliability entered to some extent, but that of economy was the principal feature.

The accompanying articles set forth at considerable length the procedure followed in designing and constructing Richmond station for reliability, low operating cost and safety of personnel. At the same time much attention has been directed to making it an interesting and pleasant work place, with a degree of success not easily depicted in words and photographs.

Baker River Exciters

IN DESCRIBING the generators installed in the Baker River plant of the Puget Sound Power & Light Company reference was made on page 549 of the March 13 issue to "two 500-kw., 125/250-volt compound-wound, interpole, horizontal-shaft exciters," thus implying that they were three-wire machines. This was incorrect, since they are two-wire generators flat-compounded for 250/250 volts.

Features of Richmond Station

Mammoth Philadelphia Electric Company Station Built in Three 200,000-Kw. Sections—First Section Uses Steam at 400 Lb. and 707 Deg.—Station Uses Phase Isolation and New Engineering Practices

By FARLEY C. RALSTON
Assistant on Staff of Chief Engineer Philadelphia Electric Company

THE property of the Philadelphia Electric Company at Delaware Avenue and Lewis Street consists of two unconnected plots, irregular in shape and separated by a portion of the sewage disposal plant property of the city of Philadelphia (Fig. 2).

The up-river plot (about 31.4 acres, with 1,520 ft. of river frontage), adjoining the bridge carrying the seashore line of the Pennsylvania Railroad, is occupied by the station. The lower, of about 32.5 acres and extending 1,588 ft. along the river, has been reserved for coal storage.

As the station stands, the complete substructure and buildings required to accommodate four turbo-generator units have been constructed (one-third of the ultimate project), and two units with boilers and all other equipment have been installed. There is also an outdoor substation stepping up to 66 kv.

The present units are rated at 50,000 kw. each. This gives a total installed capacity of 100,000 kw. and, on the assumption that the remaining units will be of the same size, an ultimate capacity per section of 200,000 kw. All ratios here mentioned are based upon these capacities. However, the present units are quite liberally designed. Loads in excess of the rating have already been carried, and it is feasible by slight construction changes to increase the rating materially, since ample boiler capacity is available for the increased ratings. Moreover, by the time additional units are to be installed sufficient experience to demonstrate the economy and reliability of even larger units may have accumulated. It is seen, accordingly, that the capacity values stated are to be considered minimum rather than maximum.

BUILDING SUBSTRUCTURE AND SUPERSTRUCTURE

In the exploration of the subsurface conditions at the plant site the first rock was encountered at a depth of 100 ft., and two gravel strata of good bearing qualities were found at 17 and 40 ft. respectively below grade.

The station building foundations consist of spread footings resting on the upper of these strata. For the coal tower, around which a depth of 18 ft. at low tide is required, the foundation has been carried down to the lower gravel stratum.

The frame members of the superstructure are silicon steel (less familiar as a structural material than for

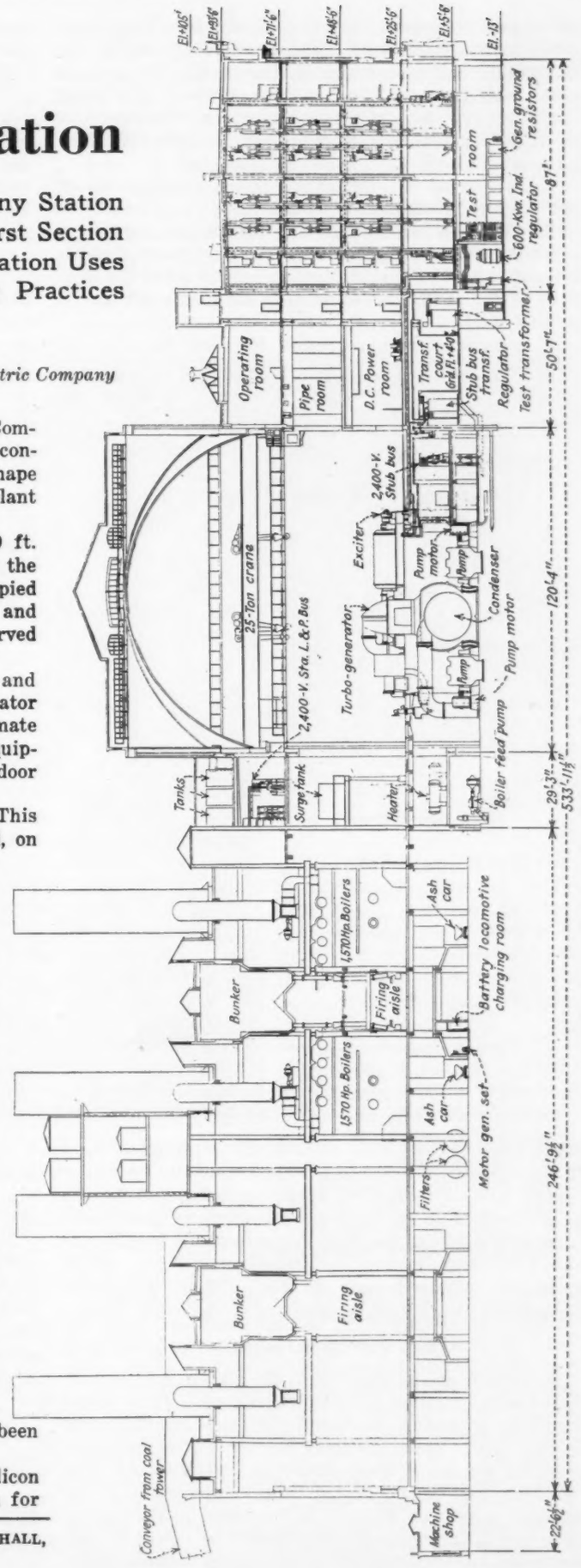


FIG. 1—CROSS-SECTION THROUGH BOILER HOUSE, TURBINE HALL, CONNECTING BUILDING AND SWITCH HOUSE

its magnetic properties) and concrete, with reinforced concrete walls and roof slabs throughout, except for the turbine hall roof, which is of gypsum. No brick or other wall facing is used, either inside or out. The exterior finish was obtained by rubbing the concrete, in which the desired color had been incorporated. The interior surfaces are rubbed and painted.

Table I gives the dimensions, areas and volumes of the principal divisions of section 3.

Between the turbine hall and the switch house is a three-story connecting building, the first floor of which is level with the turbine hall floor and with the first floor of the switch house, leaving an open court at the ground level.

A permanent administration building from which supervision of the entire station will be exercised, and in which all activities of other than a strictly operating nature will be conducted, is to be included with the second section of the station. The offices of the station superintendent and his staff, restaurant, library, lecture and conference rooms and similar facilities, which eventually will be housed in this building, occupy, in the present installation, quarters of a temporary nature.

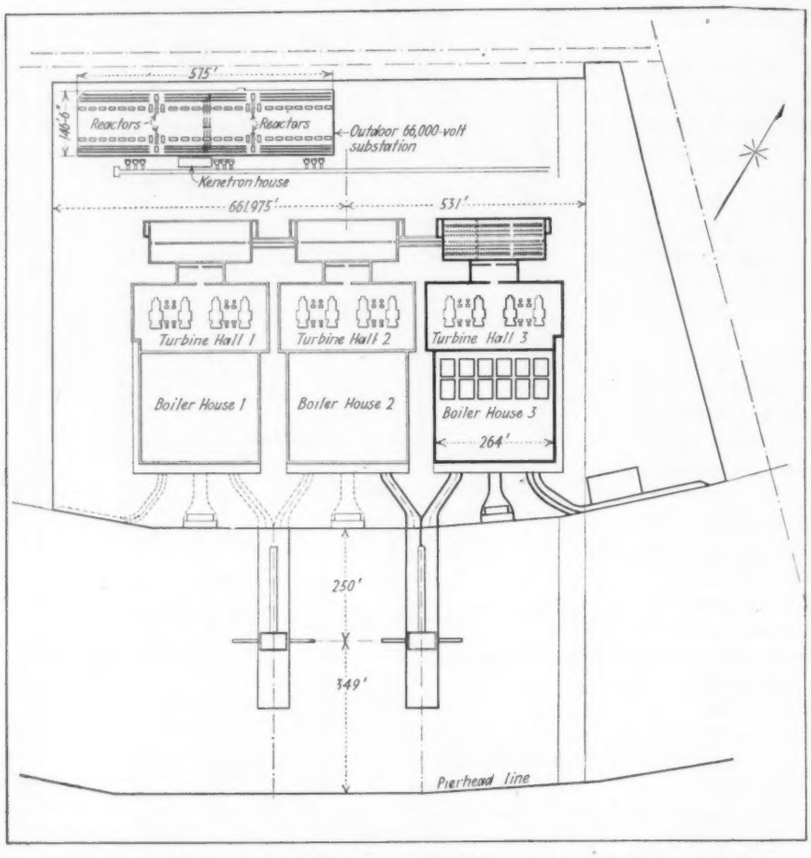


FIG. 2—PROPERTY, STRUCTURE AND EQUIPMENT PLAN, RICHMOND STATION

COAL AND ASH HANDLING

The coal normally supplied to the station is Clearfield run-of-mine medium-volatile bituminous. It is delivered only by water, whether from the Port Richmond loading piers, from the local storage lot or from the principal storage of the company on Petty's Island. The complete coal and ash-handling arrangements for section 3 appear in Fig. 8. As indicated in the station plan, Fig. 2, the completed station will be served by two coal piers, one opposite each of the spaces between boiler houses. It is the up-river pier, No. 2, that is shown in Fig. 8.

The coal tower on each pier is equipped with two hoists of 325 gross tons per hour capacity. As indicated, the coal passes from the hoist hopper first to grizzly screens; then, in succession, to picking tables and crushers, with two-way hoppers to conduct the uncrushed coal to the desired crusher and the crushed coal to the desired belt conveyor. Provision is also made for bypassing coal directly from the hoist hopper to the belt conveyors if desired.

The main belt conveyors run over weightometers at the tower end, then up the conveyor bridge, in separate fireproof compartments, to duplicate sets of cross-conveyors over each row of bunkers. The bunker capacity is sufficient for about two days' consumption.

Narrow-gage dump cars running under the ash hoppers and handled by four-ton storage battery locomotives are utilized for the removal of ash. The ash is dumped into the ash-pit and transferred as convenient by locomotive crane to ash barges.

BOILER ROOM

The general layout of the boiler room, both present and future, is shown in Figs. 1 and 2. Twelve 1,570-hp., three-bank Stirling boilers are installed in section 3, with an ultimate installation of twenty-four. Single-end firing permits the grouping of all the present boilers about one firing aisle 24 ft. wide. Fig. 6 shows clearly the arrangement of the boiler proper and of most of its accessories.

The boiler has 15,697 sq.ft. of heating surface (1.88 sq.ft. per installed kilowatt), and is built for a working pressure of 400 lb. per square inch gage. Between the first and second tube banks is the triple-tube Babcock & Wilcox superheater of 2,822 sq.ft. surface, giving a steam temperature at the outlet of 707 deg. F. Integral with the boiler is the two-drum Stirling type economizer of 7,515 sq.ft. The internal arrangement and the external appearance of the Babcock & Wilcox tubular air preheater (22,072 sq.ft.) are clearly indicated. Two soot blower elements are inserted, one from each side, just ahead of the superheater.

The furnace volume, 7,800 cu.ft., is equivalent to 0.935 cu.ft. per installed kilowatt or to 0.496 cu.ft. per square foot of boiler surface. The furnace is equipped with Bailey water-cooled side and bridge walls. Fig. 6 illustrates the location of the water-tube banks for attachment of the Bailey wall blocks and the manner of their connection into the boiler water circulation. As

TABLE I—DATA ON MAJOR STATION FEATURES

	Length, Ft.	Depth, Ft.	Area, Sq.Ft. Total	Area, Sq.Ft. per Kw.	Volume, Cu.Ft. Total	Volume, Cu.Ft. per Kw.
Boiler house	275	250	68,800	0.344	7,600,000	38.0
Turbine hall	311	152	47,400	0.237	6,200,000	31.0
Switch house (including connecting building)	230	140	27,100	0.136	2,875,000	14.4

viewed from the furnace side, the Bailey water-cooled walls are shown under construction in Fig. 3 and after completion in Fig. 4. The back of the Bailey bridge walls appears as in Fig. 5.

Each boiler is equipped with one forced and two induced fans located immediately above it. Adjustable speed, wound-rotor, 2,300-volt induction motors are used to drive all of these fans, 125-hp. motors being installed for the forced-draft and 60-hp. for each of the induced-draft fans.

The under-feed stokers (15 retorts, 25 tuyères) are driven each by a 15-hp., 250-volt, direct-current motor with a 5/1 speed range.

On each boiler, in addition to the usual graphic record of steam flow, air flow and flue-gas temperatures as finally discharged from the boiler (in this case at the outlet of the preheater), graphic record is made of the flue-gas temperatures leaving the boiler and leaving the economizer, and of the air temperatures entering and leaving the preheater.

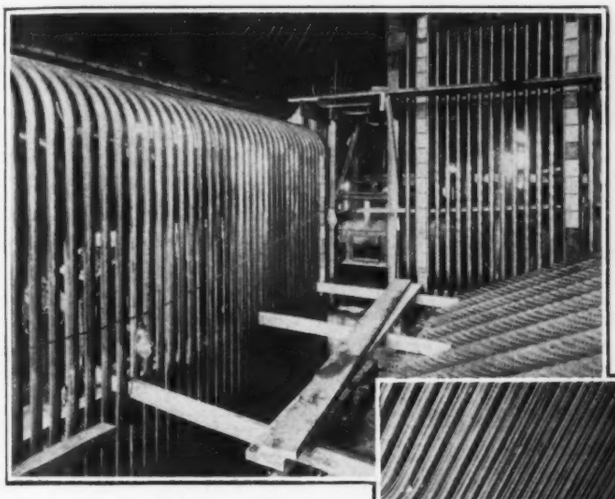


FIG. 3—BAILEY WATER-COOLED SIDE AND BRIDGE WALLS, FURNACE SIDE, UNDER CONSTRUCTION

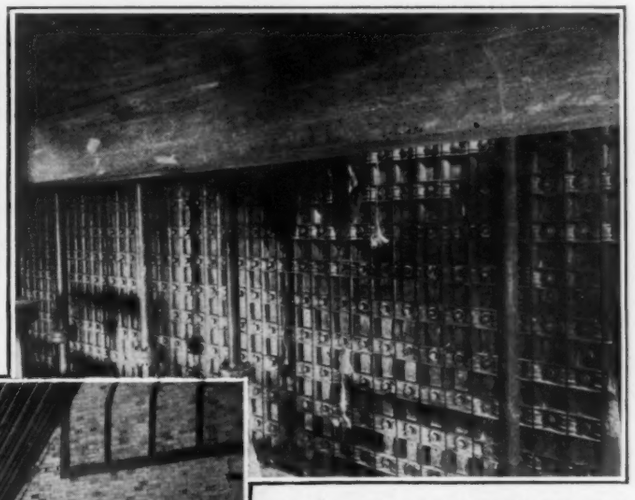


FIG. 4 — BAILEY WATER-COOLED SIDE AND BRIDGE WALLS, FURNACE SIDE, COMPLETED

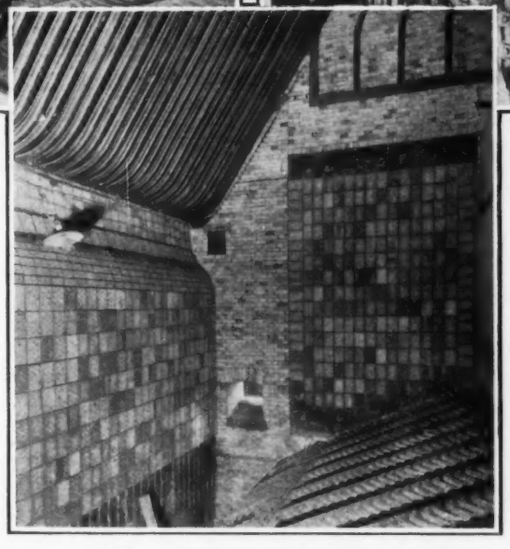


FIG. 5—BAILEY WATER-COOLED BRIDGE WALL, REAR VIEW

Centralized control is provided only for the forced-draft dampers. Each row of six boilers is under common control, with the control board at the head of the firing aisle. Since the induced-draft damper position of each boiler is automatically controlled to maintain balanced draft, the central control of forced-draft damper position indirectly controls the induced-draft dampers also. At the central control boards two six-point indicators of forced-draft damper position and wind box pressure are installed.

The speeds of stokers and forced and induced-draft fans are controlled only individually from each boiler control board.

At the center of the firing aisle are placed, back to back, two master pressure gages and two load indicators, all with 2-ft. dials.

Two boilers, one in each row, are arranged as test boilers for the station. Richardson coal scales are installed on these boilers and also permanent connections for all instruments required to conduct accurate boiler tests. Among the special problems encountered in this installation of test boilers was that of suitable metering arrangements for the steam generated in the Bailey water-cooled walls.

A special V-notch meter with four V's, carefully tested throughout its entire range from 10,000 to 1,000,000 lb. per hour, has been installed for calibrating all liquid flow meters throughout the station.

To each three boilers there is one stack—four stacks in all for the present installation. The steel breechings are each 46 sq.ft. in cross-section. Each stack is 81 ft. high and has a steel shell 16 ft. 5 in. in diameter with a 12-in. brick lining.

The regenerative cycle is employed for the heat balance of the station. The heaters are arranged according to the unit scheme, each main unit having a complete set of heaters.

From the condenser hot well the condensate pump sends the water through the first-stage closed heater (2,560 sq.ft.) and the heater de-aërator, which constitutes the second-stage heater. These heaters receive steam from the eighteenth and fifteenth stages of the main turbine respectively. From the de-aërator the boiler-feed pumps picks up the water and forces it through the evaporator condenser and through the third-stage closed heater (2000 sq.ft.), supplied from the twelfth stage of the turbine, into the boiler-feed headers.

Four motor-driven and two steam-driven boiler-feed pumps are installed. Each of the motor-driven pump sets consists of a Cameron six-stage, single-suction, 1,250-g.p.m. pump coupled to a Westinghouse 550-hp., 2,200-volt, 1,750-r.p.m., wound-rotor induction motor. Automatic speed control of these sets is obtained by a Ruggles Klingemann pressure regulator giving eighteen operating points over a speed range of 10 per cent. The steam-driven sets, which are to be used for emergency service only and are arranged to start automatically in case of failure of a motor-driven set, consist of Cameron six-stage, single-suction, 1,600-g.p.m. pumps coupled to 700-hp. non-condensing Terry turbines.

Distilled water for plant make-up is supplied by two two-effect evaporator units. These units are normally fed from the twelfth stage of the main turbine and each delivers 12,000 lb. of water under this condition. Provision is made for emergency supply from the tenth stage of the turbine. Operated thus, the output is increased to 19,100 lb. per hour.

The steam required for building heating is drawn from the tenth stage of the main turbines.

MAIN TURBO-GENERATOR UNITS

The main turbo-generator units, of General Electric manufacture, are rated at 50,000 kw., 62,500 kva., 1,800 r.p.m., 13,800–14,400 volts, three phase, 60 cycles, 80 per cent power factor, 11.8 per cent reactance. Normally, excitation is supplied by a direct-connected exciter (250 kw., 250 volts) on the end of the main shaft. Each unit is 66 ft. long, including the exciter, 25 ft. wide and 16 ft. high. Its weight complete is 550 tons, and the heaviest single part, the generator armature, weighs 97 tons. The "island" type of turbo-generator foundation has been adopted with the shafts of the units at right angles to the long dimension of the turbine hall.

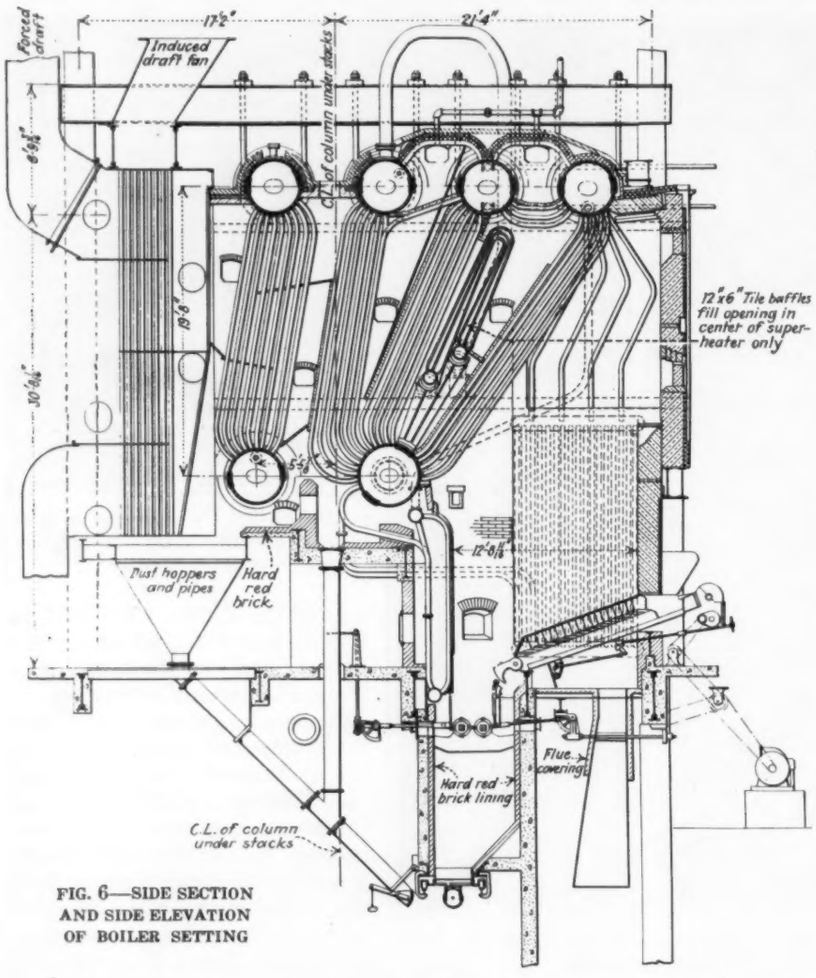


FIG. 6—SIDE SECTION AND SIDE ELEVATION OF BOILER SETTING

The turbines are twenty stage, single shaft, tandem compound, for steam conditions at the throttle of 375 lb. per square inch gage and 675 deg. F., with extraction points at the tenth, twelfth, fifteenth and eighteenth stages.

The closed system of generator ventilation is employed, with two external blowers to a unit, driven by 150-hp. motors, each blower delivering 55,000 cu.ft. of air per minute. Each air cooler has a surface of 19,700 sq.ft. and takes 1,620 gal. per minute of water from the circulating water system.

Each of the 70,000-sq.ft. surface condensers (one Wheeler and one Westinghouse) is provided with two centrifugal circulating pumps (78,000-g.p.m., 500-hp. motors), two centrifugal condensate pumps (1,200-g.p.m., 100-hp. motors), one hydraulic air pump (50-hp. motor) and one two-stage Radojet ejector.

The circulating water is drawn through a screening basin with eight revolving screens directly in front of the station and is discharged from one unit at the end of the coal pier and from the other at the up-river end of the property. The concrete circulating water tunnels have been utilized as part of the supporting foundation for the building superstructure.

A 2,000-kw., 2,300-volt, 3,600-r.p.m., three-phase, 60-cycle, 60 per cent power factor auxiliary power generator manufactured by the Westinghouse company is installed in the turbine hall as a reserve source for the station auxiliary power system. This generator, driven by a non-condensing turbine, can be automatically brought up to speed ready for load in fifteen seconds.

Vertical phase isolation is adopted in the switch house. The "A" phase is located on the third floor, the "B" phase on the second floor and the "C" phase on the first floor, with the selector mechanisms for the oil circuit breakers and the operating lever for the disconnecting switches on the ground floor. The 13,200-volt buses are separated for the entire height and length of the building by a central wall. Between the up-river and down-river half of the switch house on each floor is a cross-corridor.

Ultimately each 13,200-volt bus will form a closed ring sectionalized by reactors (10 per cent at 62,500 kva.) and oil circuit breakers, so that each section is supplied by two generators. For the present installation of only two generators, however, the ring and sectionalizing connections are not included in the switch house equipment.

The leads from the main generators run under the floor of the turbine hall, with concrete barriers between the phases, to reactors (5 per cent at 62,500 kva., 4,000,000 c.m.), thence to the main oil circuit breaker and through selector breakers to the duplicate 13,200-volt buses. The generator neutral is arranged for connection either to the station test buses or through an oil circuit breaker to a 4-ohm grounding resistor.

OUTGOING LINES

Equipment for the following lines is now installed in the switch house: Sixteen 6,000-kva. lines to company substations and industrial consumers; two 60,000-kva. lines to the 66-kv. outdoor substation; three 12,000-kva. tie lines to Delaware station; three 3,750-kva. sta-

tion power lines. A single line diagram combining the generating station layout and that of the 66-kv. outdoor substation is shown in the article by R. A. Hentz.

The "H" arrangement of lines has been adopted, by which each line has its own main oil circuit breaker and each pair of lines is connected through a selector breaker to the desired 13,200-volt bus. Reactors of 400,000 c.m. (3 per cent at 6,800 kva.) are installed on all the outgoing 6,000-kva. lines; the three station power lines are provided with reactors of 247,000 c.m. (3.3 per cent at 3,750 kva.).

Each of the three 12,000-kva. Delaware station tie lines consists of two standard 6,000-kva. cables in parallel, with 3 per cent reactors in each cable. A 630-kva., 5 per cent induction regulator, with one-half of its secondary winding in series with each of the two cables, is installed in each tie line.

All feeders, as well as the generator neutrals, are arranged for connection to the station test buses, which may be supplied at any voltage up to 30,000 by a 1,200-kva. (one-hour) transformer and a 695-kva. (one-hour)

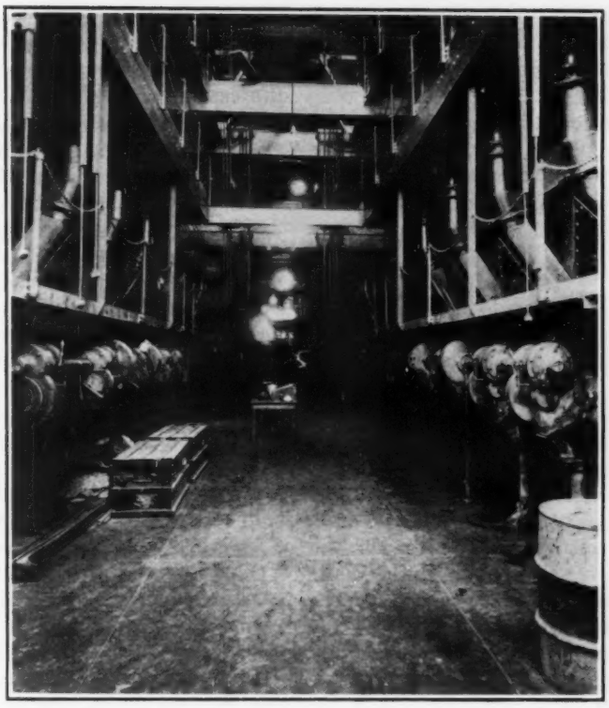


FIG. 7—BOILER AISLE

100 per cent boost and lower regulator, both manufactured by the General Electric Company.

The 13,200-volt oil circuit breakers, as well as all other electrical equipment, are insulated for 25,000 volts. For the generators and 66-kv. substation feeders 3,000-amp. General Electric FHK-13-28-B breakers, having an interrupting rating of 1,400,000 kva. at 13,600 volts, have been installed, whereas for the 12,000-kva., 6,000-kva. and 3,750-kva. feeders 1,200-amp. and 600-amp. General Electric FHK-130-20-B breakers, with an interrupting rating of 780,000 kva., have been provided. The generator neutral breakers are the Condit type D-17-B, rated at 1,500 amp., 15,000 volts, arranged for cell mounting.

Each isolated phase breaker, except main breakers on generators, has a three-pole or a six-pole gang-operated disconnecting switch, controlled by a hand lever located at the circuit breaker operating mechanism on the ground floor. The disconnecting switch control lever is interlocked so that the disconnects cannot be opened or closed unless the oil breaker is open.

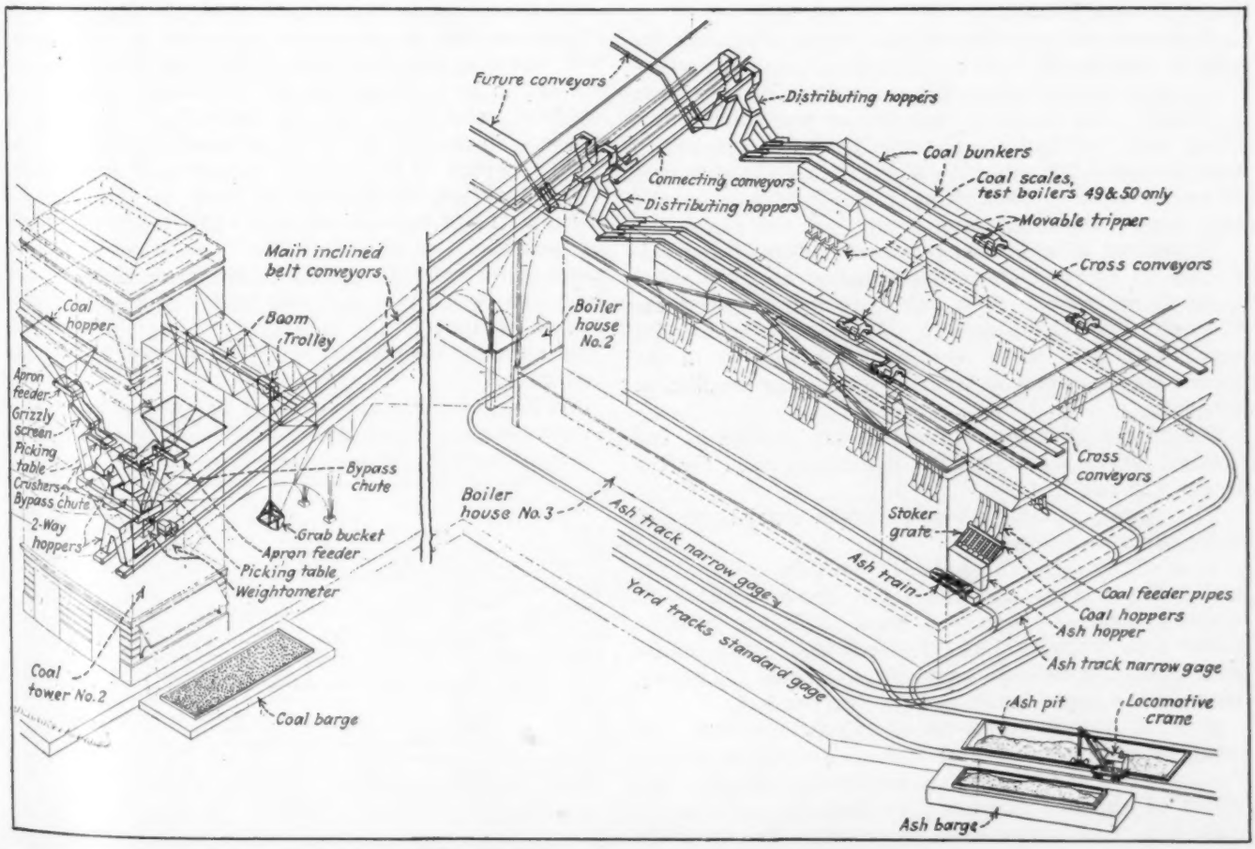


FIG. 8—ISOMETRIC VIEW OF COAL AND ASH HANDLING SYSTEM

The first floor of the connecting building is utilized for direct-current excitation and control equipment, including motor-generator sets, storage batteries and main direct-current switchboard.

In the pipe room, on the second floor of the connecting building, terminate all conduits carrying secondary and control wires for equipment controlled from the operating room. Here also are located current transformer cutouts, potential fuses, small auxiliary relays, etc.

Operating Room

The operating room occupies the third floor of the connecting building. All 13,200-volt apparatus is controlled from a semi-circular benchboard. Back of the benchboard and likewise semi-circular are, first, the instrument board, and then the relay and sectionalized control board for 13,200-volt equipment. The latter switchboards are set back to back.

To the left of the benchboard are the control and relay boards for the 2,300-volt station power system supplying boiler fan motors, motor-generator sets, water and fire pumps, etc., and for the 250-volt direct-current power and control systems. On the right of the benchboard are the boards for the auxiliary power generator and the 2,300-volt supply to turbine auxiliaries, boiler-feed pumps, generator fans, etc., and back of these boards are panels on which the generator voltage-regulating equipment is mounted.

Transformer Court and Auxiliaries

In the transformer court (Fig. 1) are located all of the transformers for the station auxiliary power system and also the induction regulators for the Delaware station tie line. The present installation of auxiliary power transformers includes three 3,750-kva. banks and two 2,500-kva. banks.

In the normal operation of the station all auxiliaries will be electrically driven. However, for reserve use only the following steam-driven auxiliaries have been provided: One steam jet air ejector per main generating unit; one boiler-feed pump per main generating unit, arranged for automatic starting in event of failure of an electrically driven pump; one condensate storage tank pump; one river water pump; one fire pump.

In general, all alternating-current motors of approximately 50 hp. and above are supplied at 2,200 volts, three phase, whereas those below are operated from the 220-volt, two-phase system. However, for special services such as those required for cranes or in the screen house, motors as large as 80 hp. are supplied at 220 volts.

Practically all 2,200-volt motors are started at full voltage, whereas compensator starting is used for the larger 220-volt motors.

The station auxiliary power system consists of five main parts as follows:

1. A 2,300-volt, three-phase, 60-cycle supply for boiler fan motors and the large non-essential auxiliaries, obtained from the three 3,750-kva. station power transformer banks. These banks feed duplicate sectionalized 2,300-volt buses on the third floor level between the boiler house and the turbine hall.

2. A 2,300-volt, three-phase, 60-cycle supply for essential auxiliaries such as turbine auxiliaries, boiler-feed pumps and generator ventilating fans. This power is supplied according to the unit scheme. A 2,500-kva. transformer bank is connected directly to the leads of each generator before they pass into the switch house and supplies a stub bus on the mezzanine gallery under the turbine hall floor. All of the essential auxiliaries associated with the generating unit (circulating, air, condensate and boiler-feed pumps and generator ventilating fans) are connected to this bus. Ties are provided from each of these unit auxiliary buses to the general station 2,300-volt system and also to another 2,300-volt bus to which the auxiliary generator may be connected. These ties are to furnish two additional sources of power for use during starting of the main unit or in emergency operation. Interlocks and relays are provided among these sources so that no two of the sources can normally be paralleled and also so that in case of failure of voltage on a stub bus in operation it is automatically disconnected from the dead source and connected to the general 2,300-volt system.

3. A 230/115-volt, two-phase, 60-cycle supply for small auxiliaries and lighting. Two 1,000-kva. Scott-connected transformer banks supplied from the general 2,300-volt system are provided for this load.

4. A 250-volt direct-current supply for stoker motors, emergency excitation and emergency throwover lighting fed by three 200-kw. motor-generator sets and a storage battery of 156 cells.

5. A 250-volt, two-wire, direct-current control supply fed by two 20-kw. motor-generator sets and two 120-cell storage batteries. This system is normally entirely separate from system 4, although an emergency tie is provided.

A six-motor crane of 125 tons capacity and 114-ft. span will handle with a liberal margin the heaviest equipment part in the station—namely, the generator armature.

Outdoor Substation

Of the ultimate twelve generators in this station it is planned that six are to be connected to the 13,200-volt buses as are the present two, whereas the other six are to be connected to the 66,000-volt buses of an outdoor substation through individual transformer banks. To provide flexibility in handling the load and also to permit of the present operation of this 66,000-volt substation, an ultimate of three tie transformers between the 66,000-volt buses and 13,200-volt buses will be provided. Accordingly the substation has been planned for controlling nine transformer banks of not less than 60,000 kva. each and sufficient lines to transmit the output of the substation to the load centers. The ultimate installation will provide for double bus operation.

At present there are installed two 60,000-kw. trans-

TABLE II—COST DISTRIBUTION FOR RICHMOND STATION

	Per Cent of Total Cost
Land	3.19
Piers and bulkheads	1.26
Dredging	1.16
Yard (fill, track, paving, planting)	1.33
Substructure	5.94
Intake and discharge tunnels and screening basin	9.65
Superstructure	26.13
Coal tower and conveyor structures	3.76
Coal-handling equipment	1.19
Boilers and stokers	10.86
Draft equipment, stacks, breechings, flues	1.39
Feed-water equipment	1.03
Boiler plant piping	5.44
Miscellaneous boiler plant equipment	3.17
Main and house turbo-generators and foundations	8.75
Condensers, auxiliaries and water system	3.04
Electrical equipment	10.99
Miscellaneous plant equipment	1.72
Total	100.00

former banks supplying two outgoing lines with temporary single-bus construction. Each of these banks consists of three 20,000-kva., single-phase, oil-immersed, water-cooled transformers.

To regulate the voltage on the 66,000-volt bus, the transformers have been constructed for tap changing under load, with a voltage range of about 10 per cent.

The oil circuit breakers provided for the 66,000-volt control have a rupturing capacity of 1,500,000 kva.

Two oil storage tanks, each of 4,600 gal. capacity, with pumping equipment and piping, are installed for handling transformer and circuit breaker oil.

For high-voltage testing of the 66,000-volt cables a direct-current kenotron testing outfit has been installed in the outdoor substation capable of supplying direct current at various voltages up to 300,000.

Table II gives the percentage distribution of the total cost of the present installation with no allowances made for the fact that parts of the present construction are applicable to the completed first section and still other parts to the station as ultimately to be developed. The cost of the outdoor substation has not been included in the figures.

The writer desires to express his obligation to the many members of the station mechanical and electrical design and construction departments of the Philadelphia Electric Company who furnished information used in the preparation of this article.

Mechanical Design of Richmond

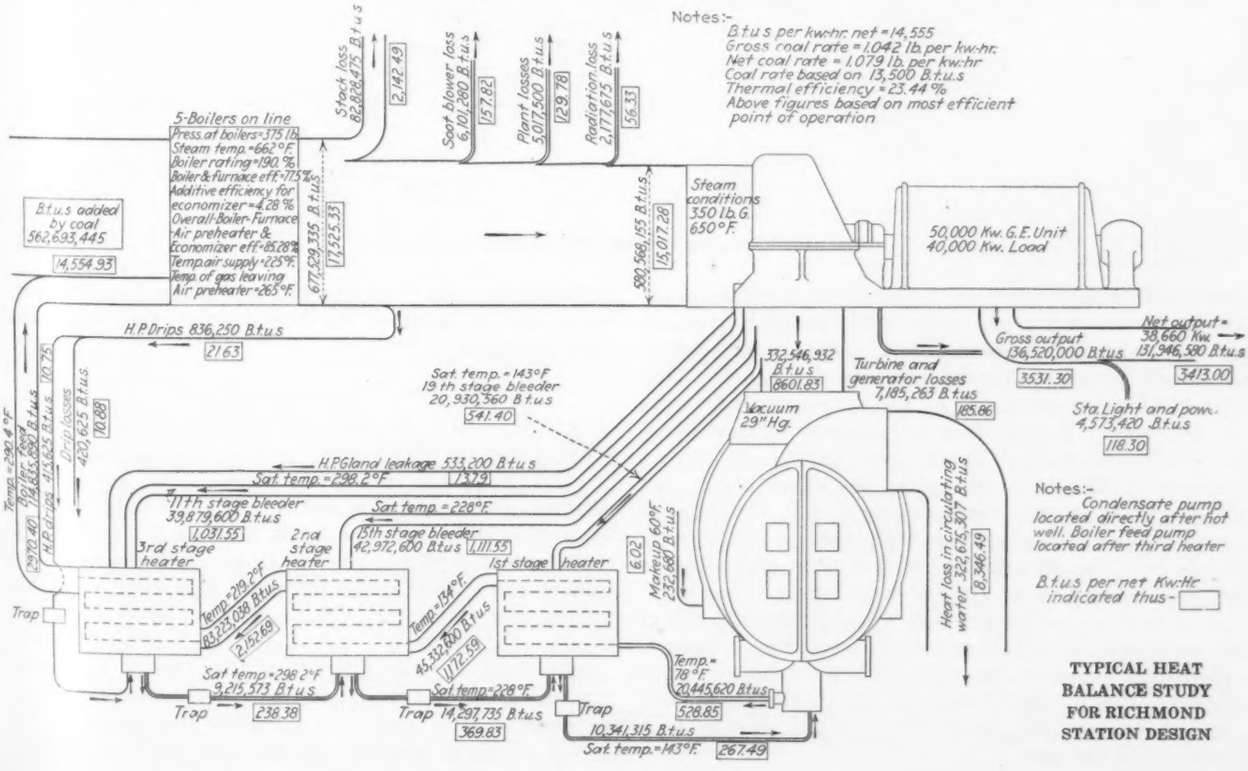
How Design Features Were Determined by Engineering Studies—Complete Cost and Heat Balance Analysis Made for Several Arrangements—Why Stokers Were Chosen—Bailey Wall Selected

By E. L. HOPPING
Mechanical Engineer Philadelphia Electric Company

LATE in the year 1922 preliminary engineering studies were started toward the design of a new generating plant to be located along the Delaware River in the northeastern portion of the Philadelphia Electric Company's territory. Since the plant was to be the largest in this company's system and at the time the studies were being made the largest projected plant in the world, it was felt necessary to secure all of the experience and ideas relating to the latest developments that could be had from other organizations.

With this thought in mind, a group of the engineers who were engaged in the design of this plant visited several of the most modern steam-electric generating stations in this country. At these plants studies were made of existing installations and the available data regarding future designs were discussed with the engineers connected with the plants visited.

In the summer of 1923 a group of the company's engineers visited a number of the more modern European generating stations and manufacturing plants to



TYPICAL HEAT BALANCE STUDY FOR RICHMOND STATION DESIGN

secure data on the latest developments abroad, especially as relating to higher pressures and temperatures, which were then coming into use.

Previous to the European trip preliminary plans had been prepared covering a considerable number of arrangements of the plant, for which preliminary heat balances were worked up. These plans and data were discussed in conference with a group of English engineers who had designed several of the most modern European plants, so that the benefit of their experience was secured in connection with the projected plans.

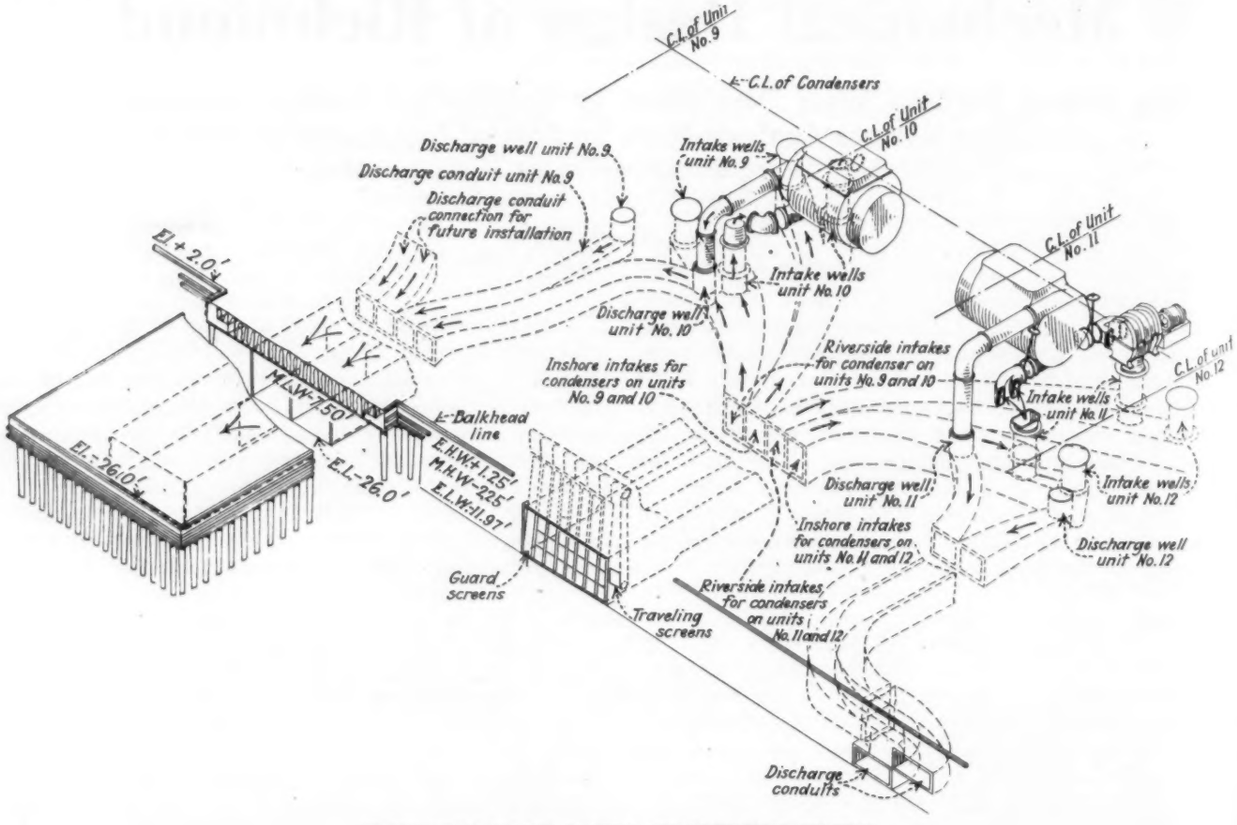
In September of the same year round-table discussions were started, headed by the chief engineer and attended by the pivotal men of the design, construction and operating departments. At these discussions every one present had an equal voice. The data secured at

Detail estimates were made of the cost of each different type of installation from which fixed charges could be calculated. The fuel and operating expense, maintenance and fixed charges were then added together to arrive at a relative total cost per kilowatt on the average yearly output.

For each of the conditions studied single-line heat flow diagrams were prepared.

Of prime importance in the consideration of any system to be used in this plant were reliability and continuity of service. Next in importance was the item of cost. Although the plant must have the maximum of reliability, this was to be secured at the lowest possible cost.

Any refinement added to the system to increase the operating or fuel economy was balanced against the


C.L. of Unit No. 9
C.L. of Condensers
C.L. of Unit No. 10
C.L. of Unit No. 11
C.L. of unit No. 12
Discharge well unit No. 9
Discharge conduit unit No. 9
Discharge conduit connection for future installation
Intake wells unit No. 9
Intake wells unit No. 10
Discharge well unit No. 10
Inshore intakes for condensers on units No. 9 and 10
Riverside intakes for condenser on units No. 9 and 10
Intake wells unit No. 11
Discharge well unit No. 11
Inshore intakes for condensers on units No. 11 and 12
Intake wells unit No. 12
Discharge well unit No. 12
Riverside intakes for condensers on units No. 11 and 12
El. +2.0'
M.L.W. +.50'
El. -26.0'
E.L. -26.0'
E.H.W. +1.25'
M.H.W. -2.25'
E.L.W. -11.97'
Balkhead line
Guard screens
Traveling screens
Discharge conduits

CIRCULATING WATER SYSTEM FOR RICHMOND STATION

home and abroad were all brought up for discussion, and as the result a group of ten different plant arrangements was studied in great detail. These arrangements consisted of two studies of pressures at 550 lb., both with bleeding systems, one of which included reheating of the steam. Seven other arrangements were based on 350-lb. pressure. These were compared with a pressure of 250 lb., representing the operation in two other plants on the company's system. The studies were based on ultimate steam temperatures of 650 deg., which, from the data secured at that time, seemed to be the most reasonable maximum temperature to consider.

In connection with the 350-lb. pressure studies, different combinations of boilers, economizers, air preheaters and various arrangements of auxiliary drives were considered. The kilowatt-hours for the year which were used in these studies, were based on an average load factor of 60 per cent.

maintenance and fixed charges, and if the resulting balance was in favor of its introduction, the refinement was approved.

STOKER FIRING SELECTED

Although all of the ten plant arrangements mentioned were based on stoker-fired boilers, the subject of pulverized fuel was not overlooked. The matter was studied in considerable detail. The operating experience of other companies up to that time was obtained and compared with our own stoker operation and the subject very thoroughly discussed with both manufacturers and operators. The consensus of opinion was finally that, although pulverized fuel offered certain possibilities, a plant located on the edge of a densely populated district would have to be constructed so as to operate with the least possible annoyance to adjacent property owners. At that time with pulverized-

fuel installations there was no satisfactory arrangement for collection of dust, and it was believed that this feature alone might create considerable difficulty.

A factor in the decision regarding pulverized fuel was that the available coal supply in this territory is of a very high grade and that a poorer grade of coal, although costing less per ton at the mine, would cost more per kilowatt-hour because of the added transportation expense required to deliver an equivalent British thermal unit value to the plant.

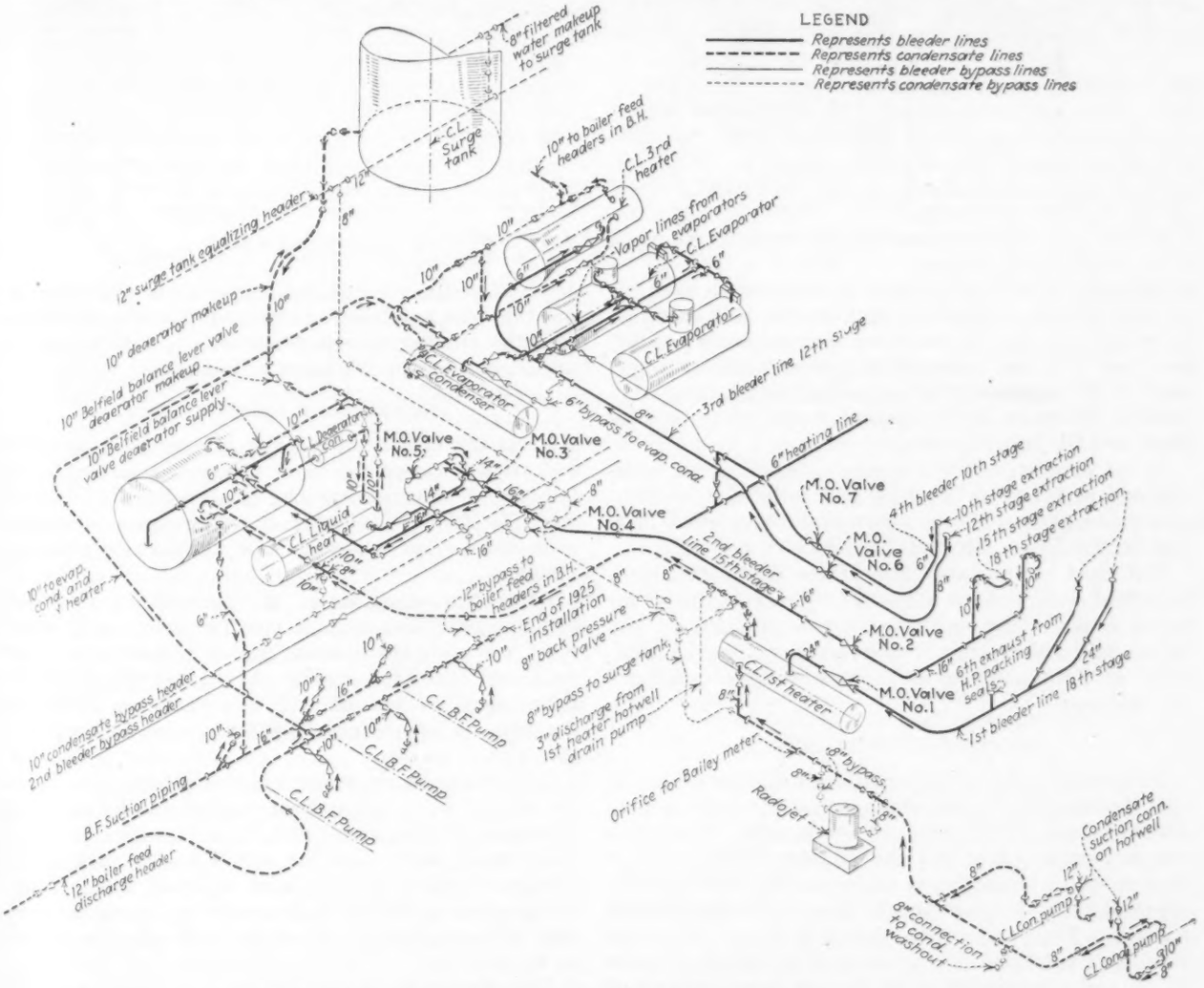
Another consideration, that of the operation of a large coal preparation plant, which was necessarily attached to pulverized-fuel installations, created an added complication to the plant operation and at the same time considerably increased the capital cost. It was therefore decided that pulverized fuel should not be considered for the first section of the new station.

Operators Freely Consulted

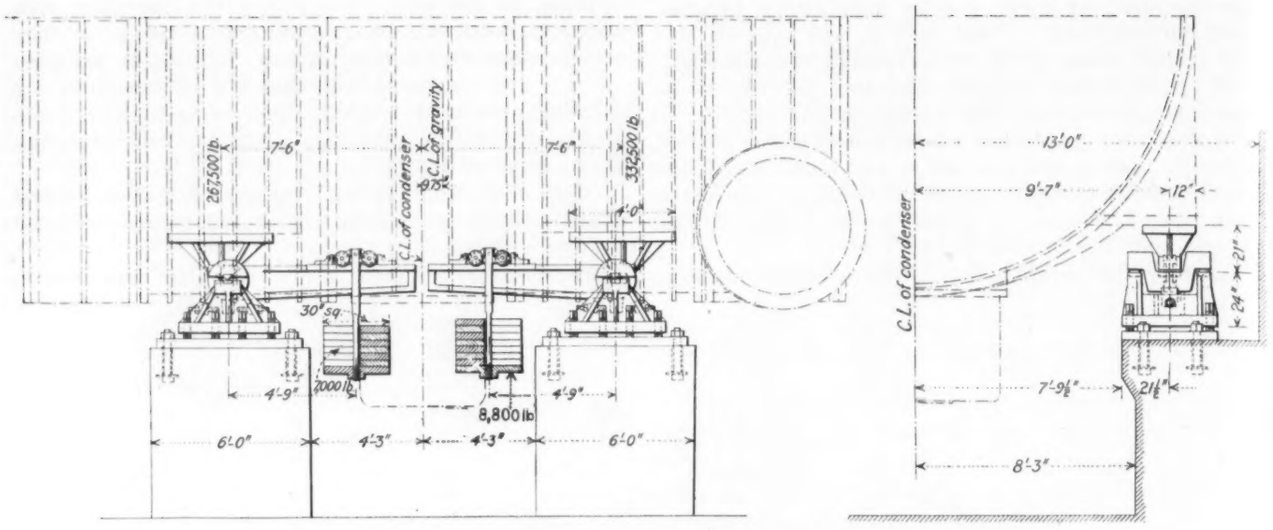
After having made definite decisions as to the type of system to be used in the plant and as to the general arrangement, all of which are discussed in further detail in a later part of this article, the principal operating men who were to have charge of the new plant were called in for frequent consultation with the design men, who in this manner secured their practical advice and opinion, at the same time giving the operating men complete detail information regarding the plant they would eventually have to operate. By such an arrangement a great many details that add to the operating efficiency are secured that would be lacking in cases where the close co-operation of design and operating forces does not exist.

Most of the outstanding features of the mechanical design that resulted from the procedure are discussed here in some detail.

The original projected size of the plant was 600,000 kw. for the ultimate capacity, 200,000 kw. of which was to be installed in one of three separate buildings located adjacent to one another and arranged as shown in F. C. Ralston's article. The purpose of dividing the plant into separate sections was to create a certain element of safety that could not be obtained if all the units were in a single building. A break in the steam line in a modern plant having high pressures and temperatures might very quickly cause a complete shutdown; whereas with the plant divided into sections, a break would affect only the section in which it occurred. Such a division of the building makes possible the adaptation of any new development in the design of the second and third sections of the plant. Dividing the plant into sections also adds somewhat to the light and ventilation


LEGEND
Represents bleeder lines
Represents condensate lines
Represents bleeder bypass lines
Represents condensate bypass lines
8" filtered water makeup to surge tank
C.L. Surge tank
10" to boiler feed headers in B.H.
C.L. 3rd heater
12" surge tank equalizing header
Vapor lines from evaporators
C.L. Evaporator
10" deaerator makeup
10" Belfield balance lever valve deaerator makeup
10" Belfield balance lever valve deaerator supply
C.L. Evaporator condenser
6" bypass to evap. cond.
3rd bleeder line 12th stage
6" heating line
C.L. Deaerator coil
M.O. Valve No. 5
M.O. Valve No. 3
M.O. Valve No. 4
M.O. Valve No. 7
M.O. Valve No. 6
M.O. Valve No. 2
M.O. Valve No. 1
4th bleeder 10th stage
10th stage extraction
12th stage extraction
15th stage extraction
18th stage extraction
C.L. Liquid heater
10" to evap. cond. and 1st heater
12" bypass to boiler feed headers in B.H.
End of 1925 installation
8" back pressure valve
2nd bleeder line 15th stage
6th exhaust from H.P. packing seals
C.L. 1st heater
1st bleeder line 18th stage
8" bypass to surge tank
3" discharge from 1st heater hotwell drain pump
10" condensate bypass header
2nd bleeder bypass header
C.L. B.F. Pump
C.L. B.F. Pump
C.L. B.F. Pump
B.F. Suction piping
12" boiler feed discharge header
Orifice for Bailey meter
18" bypass
Radojet
Condensate suction conn. on hotwell
6" connection to condr. washout
C.L. Cond. pump
C.L. Cond. pump

STAGE BLEEDING AND BOILER FEED WATER ARRANGEMENTS FOR RICHMOND STATION



COUNTER-BALANCE WEIGHT ARRANGEMENT FOR 70,000-SQ.FT. SURFACE CONDENSER

obtainable. This arrangement, in conjunction with the selected scheme of handling coal, results in a condition by which only one of the three sections could possibly be closed down by reason of failure or accident to any part of the coal-handling equipment, either in the unloading towers or in the conveying structures between them and the boiler houses.

In the completed plant a central administration building will be provided in which will be located, in addition to the general offices, a restaurant, recreation room and central locker and toilet rooms.

The local maintenance and stores are located in a projected section of the building on the river side of the boiler house. This space, which was provided at very little additional expense, creates rooms giving the maximum of light and ventilation and is well suited for this purpose.

CIRCULATING WATER SUPPLY

Reference to the accompanying illustration will indicate the unusually flexible arrangement of water conduits for the supply and discharge of condensing water. These are so arranged that any one of them can be entirely shut down for inspection or repair and the unit normally supplied from that conduit can operate on the adjacent conduit. The level in the Delaware River, on which this plant is located, has an average variation of about 5½ ft. and a maximum of 12 ft. At normal operating conditions the velocity at average low water is 2½ ft. per second and at extreme low water is only 3 ft. per second, so that under the worst conditions the head loss in this system is very small.

Due to the fact that the river is tidal, it is necessary to use considerable precaution in locating the point of discharge with respect to the intake basins. From careful studies of temperatures adjacent to the mouth of discharge conduits in other plants on the system, we were well satisfied that the distance of 500 ft. provided between the intake and discharge at this plant was ample to prevent any increase in intake temperatures due to a possible recirculation.

All of the conduits from the river face of the boiler house back to the turbine proper were constructed as part of the building foundation work. Because of the nature of the soil, which determined the necessary depth of building foundations, very little additional excavation was required for the conduit work, and therefore the circulating water system for this plant was constructed with a minimum of expense.

BOILER PLANT ARRANGEMENTS

From the final results of the studies outlined above and from a consideration of the system which it was felt would be most reliable, the pressure of 350 lb. with 650 deg. F. was selected as the steam conditions, with three-stage bleeding and all electric auxiliary system.

After the selection of the general arrangement, actual negotiations were started for purchase of equipment, and since the Stirling type of boiler was selected, we found that an operating pressure of 400 lb. at the boiler could be secured with practically no additional expense. It was decided, therefore, to avail ourselves of this higher pressure.

The steam temperature to be used was also raised to 740 deg. F. at maximum rating of the boiler. This arrangement was expected to give an average steam temperature at the turbine of 675 deg. F. and an operating pressure at the same point of 375 lb. gage. These changes naturally increased the operating economy of the arrangement selected and added very little to the cost.

The studies indicated at that time that large air preheaters would be most economical to use in connection with the boilers. It was felt, however, that these large air preheaters, which would produce air temperatures of approximately 700 deg. F., might create certain operating difficulties and that it would therefore be unwise to go ahead with that scheme.

At another station in the system smaller air preheaters used in back of an economizer section were giving excellent results. It was therefore decided that the boiler should be constructed in combination with economizers and small air preheaters giving air temperatures of about 325 deg. F.

In most of the modern central stations at that time furnace conditions were not all that could be desired. In this company's system air-cooled blocks were used in the bridge and side walls, which introduced a certain amount of secondary air and caused low CO_2 at the

sides of the boiler. The maintenance cost of bridge and side walls was also felt to be too great.

To better these conditions the Bailey type of water-cooled furnace wall was finally selected for installation in the bridge and lower portion of the side walls—parts of the boiler subject to the greatest punishment. The two principal reasons for selection of this construction were:

1. A considerable reduction in maintenance cost of this portion of the furnace.

2. This type of wall would also allow the use of higher CO_2 because of its ability to withstand greater punishment than with the ordinary type of refractory furnace. Part of the increased CO_2 would result from a higher average by elimination of secondary air at the side walls.

The other features in connection with the boiler plant design were mostly of the conventional type, and are described in detail in another part of this issue in the article by F. C. Ralston.

Turbo-Generator Features Studied

A great deal of thought was given to the selection of the turbine. The subjects of speed and of multi-shaft units were gone into in great detail. In order to fit into the system properly, a capacity of not less than 50,000 kw. had been decided upon and discussions with the various manufacturers finally led to the choice of a single shaft 1,800-r.p.m. machine. This was the largest single shaft machine ever constructed to operate at this speed and presented a number of difficult problems that were successfully worked out by the turbine and generator manufacturer.

The cross-compounded type of unit was rejected because of the difficulty of securing the same type of installation that has always been a standard in this company—that is, the island type construction, where practically all of the turbine room auxiliaries are visible from the operating platform and where the maximum amount of light and ventilation can be secured for the operation of these auxiliaries.

Another reason for the rejection of the cross-compounded unit was the added complication of steam supply in the form of additional throttle valves, governing mechanism, etc. It was felt that the greatest simplicity and reliability could be secured with the single-shaft machine, where only one set of governing mechanism and one throttle valve are required. Certain other electrical advantages are to be obtained by use of the single-shaft unit and are discussed elsewhere in this issue.

A great deal of thought was given to the design of the foundations for this large unit. An extended study of vibration and deflection was gone into so that on the completed work there could be no question as to alignment of the machine or as to vibration.

A steel structure was first designed, made sufficiently strong to carry all of the imposed loads plus 50 per cent impact, and around this steel structure reinforced concrete was placed for the purpose of adding stability to the entire structure. The operation of the unit has proved to the company the wisdom of using so much care in this part of the design.

Condensers Are Counterweighted

The condenser installation in this plant is of the usual type, but there are one or two unique features in connection with it.

The most radical departure from past practice is the use of counterweight supports under one of the condensers. This method of support was worked out by one of the company engineers and patents have been applied for. The scheme has been described in detail in a report of the prime movers committee of the N.E.L.A. and is illustrated in accompanying drawings.

The use of this type of support produces a known load on the turbine, whereas with the spring type of support it is very difficult to measure exactly the load produced on the turbine exhaust flange. The erecting time required for the counterweights is also very much less than that required for the spring supports. After this type of support is once installed no further worry is necessary regarding fatigue of metals, such as is the case with the spring supports.

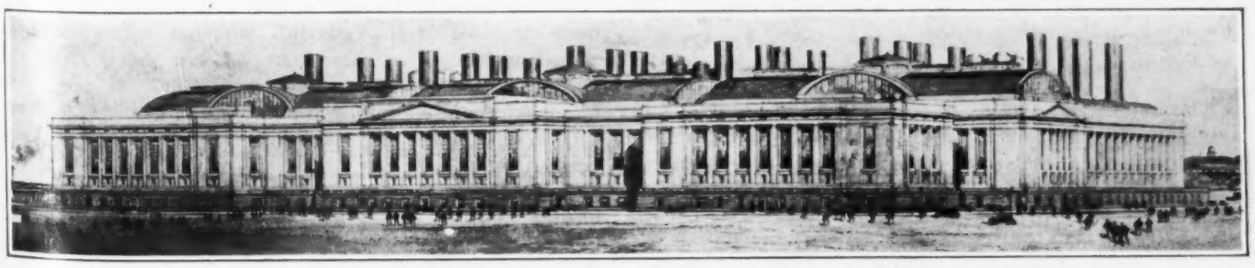
This installation was the first in this company's system where condenser tubes were rolled into the tube sheet on the inlet end. The outlet end of all tubes is made tight with metallic packing.

Usual practice was followed in this plant in that all of the condenser auxiliaries are installed in duplicate, thus making it unnecessary to shut down the main unit due to a failure of one of the auxiliaries.

Heat Balance System Based on Three-Stage Bleeding

The studies mentioned earlier in this article indicated that for our conditions the three-stage heating, which was finally selected, giving a feed-water temperature of approximately 300 deg., would be most economical.

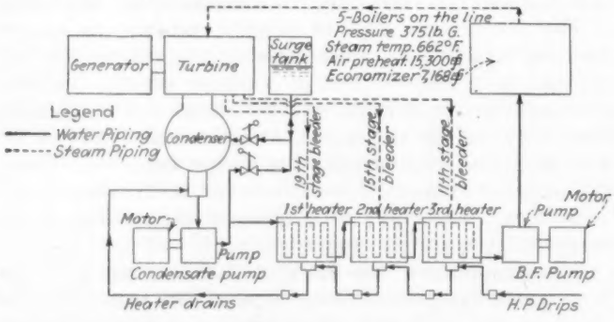
Bleeder connections are provided at four points on the turbine—the tenth, twelfth, fifteenth and eighteenth stages respectively. The tenth stage bleeder steam is used only for building heating and for the purpose of increasing the capacity of evaporators in case of any excessive demands for make-up water. The three other stages are used in the normal operation of the heater system. Although the entire system is closed and should not permit the entrance of any excessive amount



VIEW OF RICHMOND STATION FROM ARCHITECT'S PLANS

of oxygen into the feed water, it was felt that even the amount that leaks in through packing glands and other sources should be removed so that oxygen-free water would be fed to the steel tube economizers that are installed back of the boilers. A de-aërating type heater was therefore selected for use on the fifteenth stage bleeder. This heating unit consists of the de-aërator, its condenser and a liquid heater. It produces feed water which, in normal operation, is practically free of oxygen. The eighteenth stage and fifteenth stage, or de-aërating heater, are both low pressure and the feed water passes directly from the de-aërator storage chamber to the boiler-feed pumps. From the boiler-feed pumps the water passes through the twelfth stage heater and, when required, through the evaporator condenser and then on to the boiler plant.

The isometric illustration shows the flow of vapor and water through the system. In addition to the connections shown on this diagram, bypasses have been provided around each of the elements so that the system



THE ISOMETRIC ILLUSTRATION SHOWS GENERAL LAYOUT OF BLEEDING AND HEATING SYSTEM

can be operated in spite of the failure of any single element contained therein.

The question of de-aëration being deemed by this company one of the very important functions of the heater system, interconnections were provided between the two units now installed so that both main units could operate through a single de-aërator. This, of course, adds somewhat to the complication of the system, but the advantages gained by being able at all times to obtain de-aëration overbalanced the disadvantages.

As an auxiliary to the feed-water system two large storage tanks have been provided into which all excess water overflows from the surge tanks. In case a boiler is to be emptied, the water from that boiler is also emptied into one of the tanks and allowed to settle. In this manner the work to be performed by the evaporators is at all times kept at a minimum. The pumps taking their suction from these storage tanks are arranged to discharge water automatically into the system whenever the water reaches a certain predetermined low level in the surge tanks.

Boiler Feed Pumps in Triplicate

The boiler-feed pumps in the system are provided in triplicate for each main unit, two of them being motor driven and the third steam driven. Motor-driven pumps are controlled by the differential of steam and boiler-feed pressures through a Ruggles-Klingemann regular working through eighteen control points on the motor. This arrangement produces smoothness of control almost equivalent to that obtained on a turbine-driven pump. One pump is of sufficient capacity to provide for maximum output of the main unit, the second being a spare or reserve unit. The turbine-driven pump is installed to meet emergency conditions only, since the introduction of exhaust steam from auxiliary drives would upset the economy of the entire heat balance system. This pump is arranged so that in case of failure of the motor-driven pumps the turbine will come into service automatically.

Miscellaneous Decisions to Secure Reliability and Control

Motors were used to drive all of the miscellaneous pumps throughout the plant, and wherever a system, such as the house water system, required extra precautions in case of electrical failure, a turbine-driven pump was provided, which would be used only in emergency. In normal conditions there is no steam-driven equipment in operation other than the condenser air removal apparatus.

The use of remote-controlled motor-operated valves in both the steam and high-pressure feed-water system is as extensive here as in any plant built at the present time. Practically all of the high-pressure valves are motor operated, and remote control is provided on a sufficient number of valves to allow for sectionalization of comparatively small sections of the piping system. Mercoid gages are provided in certain sections of the steam and feed-water systems which will indicate on the control board any excessive pressure drop due to a local failure. By this means it is hoped that the section can be cut out with a little more certainty as to where the failure has occurred. The room in which the remote control is placed is accessible only from an outside balcony, so that even if the room adjacent to the control room were filled with steam, it would still be possible to operate the sectionalizing valves.

One of the very important features in this plant is that of power supply to the essential auxiliaries, such as circulating, air, condensate and boiler-feed pumps. The functions of this system, however, are largely electrical, and a detailed description of the scheme is to be found in another article in this issue, covering the electrical features of the plant.

Many Inventions Plus Three Children Bring Reward to French Engineer

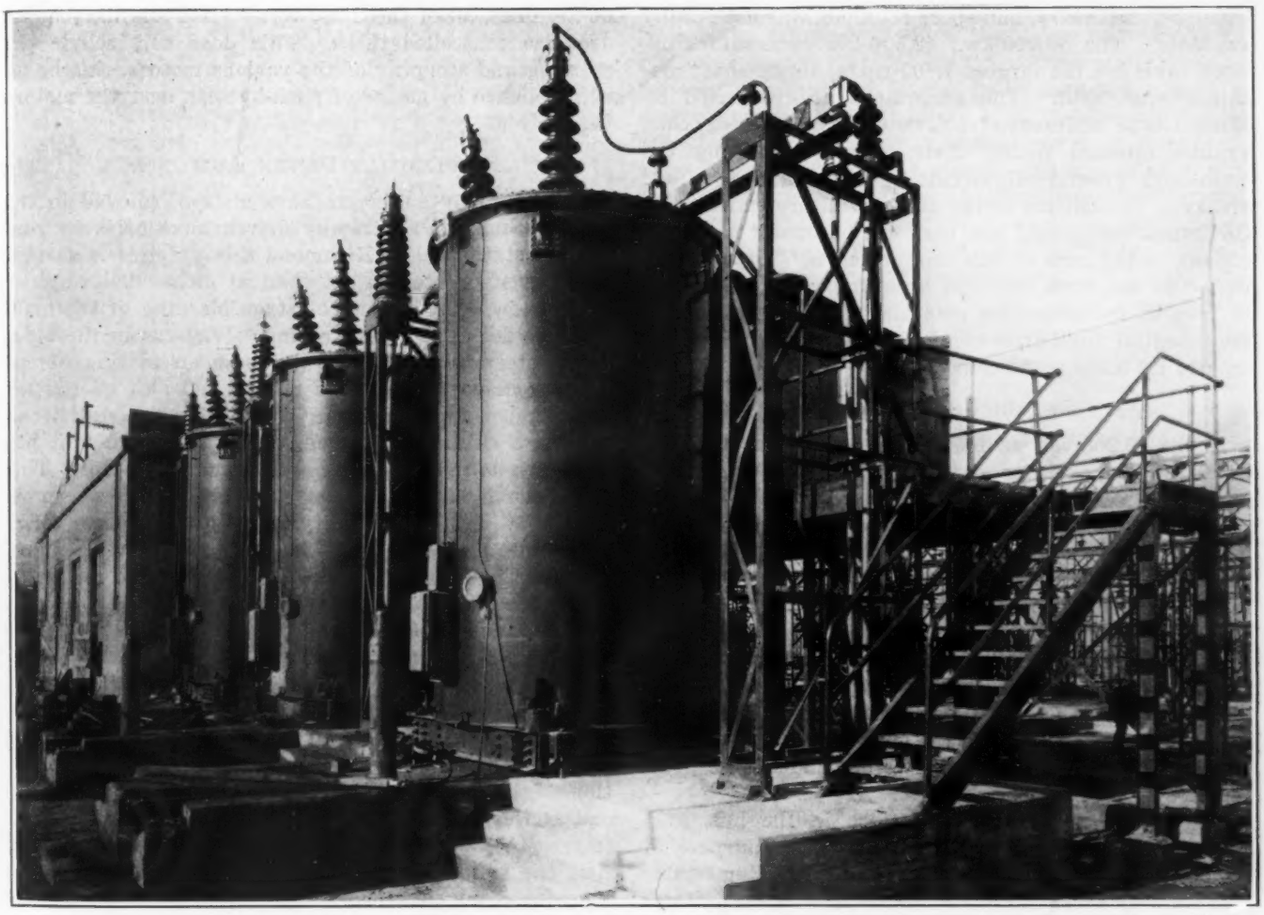
AMONG the annual premiums awarded by the French Office National des Recherches Scientifiques et Industrielles is that known as the Jean Bares award, which is offered to the inventor who is the father of at least three children and who is regarded as having rendered the greatest service to French industry. For 1925 the premium, which amounts to 10,000 francs, has been awarded to M. Vedovelli, who not only fulfills the requirements as to parentage but has risen from the rank of an ordinary engineering fitter. M. Vedovelli has more than one hundred patents and has a wide reputation in connection with high-tension apparatus and control gear.

It was M. Vedovelli who was responsible for the electric luminous fountains at the Paris Exposition of 1900, and 25 years later for the electric waterfall and other electrical illuminations at the Paris Decorated Arts Exhibition of 1925.

Electrical Features of Richmond

Equipment Selected to Give Best Operation on Interconnected System of Philadelphia Electric Company—Protection Features Accentuated—Phase Isolation Used for Switch House—Electric Drive for Auxiliaries

By R. A. HENTZ
Electrical Engineer Philadelphia Electric Company



RICHMOND OUTDOOR SUBSTATION, 60,000-KVA. TRANSFORMER BANK AND KENOTRON TEST-SET HOUSE

THE electrical design of the Richmond station follows in many aspects that used in the Delaware and Chester stations of the Philadelphia Electric system, though there are a few major and several minor departures. A description of a few of the more important features of the plant, with reasons for following or departing from existing station design, may be of interest.

The electrical design was, of course, influenced by the location of the load to be supplied. Being close to a number of existing substations already supplied by 13,200-volt lines, the bulk of the power transmitted from the first building unit will be at that voltage. However, 66,000 volts is used for the longer tie lines and for supplying two neighboring utilities whose loads are expected to grow to fairly large proportions. This voltage had already been established between Chester and Schuylkill, the lines connecting these stations together with those from Richmond forming the beginning of an extensive 66-kv. transmission system.

The Richmond station is tied to the Delaware, Schuylkill and Chester plants. With the Delaware station it is connected by means of three 12,000-kva., 13,200-volt lines, each consisting of two 350,000-circ.mil cables, the power factor of whose load is controlled by a 630-kva., 13,600-volt, three-phase induction regulator, giving 5 per cent buck and boost. The use of two such cables in parallel not only permitted the use of a transmission cable already standard with the company, but also permitted a balanced relay scheme which is desirable for tie line protection. The regulators have two sets of series coils, each of which is connected to one of the two cables, thus including the regulators in the balanced relay protection. Overload relays with high setting are also provided. With the completion of this year's work, a 66-kv. tie will be established with the

Schuylkill plant, at which time it will be necessary to open the 13,200-volt ties now existing between Delaware and Schuylkill. This is necessary in view of the phase angle introduced by the regulators mentioned above, and to a far greater extent to that caused by the current over the 66-kv. lines and transformers.

As pointed out in the other articles, considerable thought was given to the question of cross-compound versus single-shaft turbo-generators. Not only for the mechanical reasons there indicated but because the electrical layout with a single-shaft unit is considerably simpler, this type was adopted. Had the cross-compound been used, additional oil circuit breakers would have been necessary, and space for them was not readily available. The 50,000-kw., 62,500-kva. generators decided upon are the largest 1,800-r.p.m. single-shaft machines ever built. The generators are protected by plunger-type differential relays with restraining coils against internal faults, their operation opening the main and ground oil circuit breakers and the field breaker. In addition to the differential protection, type CZ impedance relays are used to disconnect the generators in the case of bus short circuits. Their operation does not open the field breaker, as it is desirable to keep up the generator potential for the operation of the essential auxiliaries connected (through transformers) to its leads as described later.

Switch House Layout

In the 13,200-volt switch house the "H" layout, used in all of the existing stations, was employed. Of a number of schemes considered, this seemed to possess the best combination of flexibility and economy in that it provides a "back-up" breaker for the line breakers, ties up a maximum of only two lines when there is a failure at any one point and does this at a cost of only two breakers per line. The switch house does differ from the older ones in that isolated phase construction is used, it being of the vertical type. The oil circuit breakers are of the dead-pot, gravity-open design which has always been deemed a desirable type for bus "selectors," and the "mains" were made of the same type.

The layout provides for reactors in the bus, generator leads and outgoing feeders for the purpose of reducing short-circuit currents and providing stable operation by keeping the voltage on unaffected parts as high as possible at times of trouble. The main reliance, of course, is placed on the feeder reactors for these functions.

All the equipment in the switch house is rated at 25,000 volts. This is higher than that employed for equipment in the company's other plants, and it was adopted to obtain a greater factor of safety. No trouble had been experienced with the use of equipment with a lower voltage rating, but the greater concentration of energy in the event of trouble, together with the greater importance of the station due to its size, warranted such a precaution.

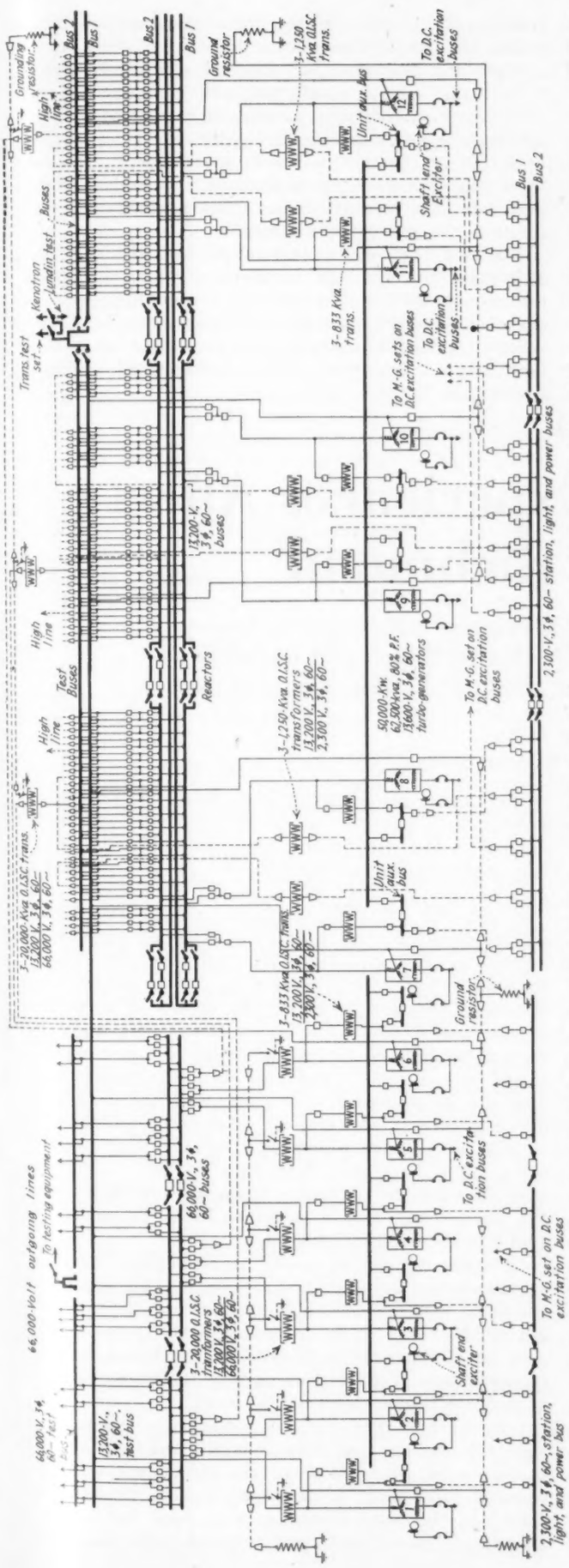
The compartment doors in the switch house are locked by the Cory scheme. This scheme prevents the possibility of any one getting into a compartment which has not been disconnected from the bus. The gang-operated disconnecting switches are mechanically interlocked with the oil circuit breakers so that they cannot be opened until after the oil circuit breaker has been opened. When the disconnecting switches have been opened, they can be locked in the open position by means of a key which can then be removed from its slot. This key will unlock a series of other key slots, each containing one key, these keys being used to unlock their respective compartment doors. Before the compartment can be put back in service all the keys must be returned to their respective slots in order to release the key to unlock the disconnecting switches.

The operating room, which is of generous proportions, is on the top floor of a connecting building spanning the space between the switch house and the turbine hall and looks out upon the latter. In addition to the control of the main generators, and the 13.2-kv. and 66-kv. lines, all of the 2,300-volt station auxiliary buses are also controlled there. This does not include the starting and stopping of the various motors, this being accomplished by means of push-buttons near the motors themselves.

Electrically Driven Auxiliaries

The company engineers have always believed in the extensive use of electrically driven auxiliaries in generating stations. At Richmond this practice is carried to an even greater extent than at either Delaware or Chester owing to the use of stage bleeding of the main turbines for feed-water heating. Whereas in the older plants steam was used for the main circulating pumps (duplex drive), boiler-feed pumps and half of the air and condensate pumps, in the Richmond station all these are electrically driven, except that each unit has a reserve boiler-feed pump and steam air ejector. This has made it most important that the electrical supply be of the highest reliability. Supply from transformers connected to the main bus was therefore excluded and the problem was reduced to the selection of one of three general schemes—the auxiliary turbo-generator, the shaft-end generator and the transformer connected to the leads of the main generators. The cost of the first name eliminated it as a regularly operating unit, though an emergency non-condensing unit is provided. As between the alternative methods that remained, the shaft-end generator added some mechanical complication to the main unit, since the retention of the shaft-end exciter, whose operation had been very satisfactory in the other plants, was desired. While it was realized that the transformer connected to the generator leads introduced an electrical complication, nevertheless the very high reliability of the modern transformer made this of but slight importance. With this scheme, should the generator switch open while carrying load, a potential considerably above normal will be impressed upon the transformers, and therefore they were designed to withstand such overvoltage. This has resulted in a transformer with a high factor of safety under normal operating conditions.

As mentioned already, a stand-by auxiliary generator is provided. This is of 2,000-kw., 3,300-kva. capacity and is capable of starting and running enough auxiliaries to get the plant back into service in case there is a complete shutdown and no means of getting energy from other generating stations. The machine is especially designed to start large 2,300-volt motors, which are arranged for full voltage starting, and this accounts for the rather large kva. rating. It can be started from the operating room and brought up to speed and on the line in fifteen seconds. This is accomplished by a control switch which first starts the


Grounding resistor
High line
Bus 2
Bus 1
Ground resistor
3-1250 Kva. O.I.S.C. trans.
To D.C. excitation buses
Unit aux. bus
Shaft end Exciter
Kenotron
London test
Buses
Trans test set
3-833 Kva. trans.
To M-G. sets on D.C. excitation buses
13,200-V. 3φ, 60~ buses
Test Buses
Reactors
3-1250-Kva. O.I.S.C. transformers 13,200 V., 3φ, 60~ 2,300 V., 3φ, 60~
50,000-Kw. 62,500-kva., 80% P.F. 13,600-V., 3φ, 60~ turbo-generators
To M-G. set on D.C. excitation buses
2,300-V., 3φ, 60~ station, light, and power buses
3-20,000-Kva. O.I.S.C. trans. 13,200 V., 3φ, 60~ 66,000 V., 3φ, 60~
3-833 Kva. O.I.S.C. trans. 13,200 V., 3φ, 60~ 2,300 V., 3φ, 60~
Ground resistor
66,000-Volt outgoing lines
To testing equipment
66,000-V., 3φ, 60~ buses
To D.C. excitation buses
To M-G. set on D.C. excitation buses
3-20,000 O.I.S.C. transformers 13,200 V., 3φ, 60~ 66,000 V., 3φ, 60~
Shaft end exciter
66,000 V., 3φ, 60~ test bus
13,200-V., 3φ, 60~, test bus
2,300-V., 3φ, 60~, station, light, and power bus

bearing oil pump and then in conjunction with an oil-pressure relay opens a motor-operated valve which admits steam to the turbine.

Motor Controls

All motors of about 50 hp. and above are 2,300-volt and are arranged for starting at full voltage, this resulting in a simpler means of starting, not only normally, but upon re-establishment of voltage after an interruption.

The motor-driven boiler-feed pumps are of interest in that they are provided with eighteen running points over a speed range of approximately 10 per cent.

A Ruggles-Klingemann differential pressure regulator is used in conjunction with the drum controller, the regulator being operated by the differential pressure between the boiler and the boiler-feed-water supply. Any change of approximately 1 lb. in this differential pressure will cause a set of contacts to close, thus operating the drum-controller motor. By means of a cam arrangement which is geared to the drum controller, the differential pressure required to close the contacts is changed for each step on the drum controller, thereby requiring a different differential pressure for each motor speed. This is necessary when two or more pumps are running in order to keep them operating at the same speed and keep the load equally divided between the pumps.

In the older stations a single-control system is employed consisting of one storage battery and two motor-generator sets, use being made of the three-wire control system, solenoids, etc., being rated at 250 volts and the indicating lamps connected between outside wires and neutral. In the Richmond station provision has been made for the automatic operation of the selector oil circuit breakers. In order to insure their operation in the event of any failure of the main oil circuit breakers to open, it was decided to put the selectors on a separate control system from the mains. Therefore two control storage batteries and two motor-generator sets are provided and the entire scheme of sectionalized control is laid out so that the "mains" and "selectors" may be thrown to either one of these two control systems. There is also an emergency tie running from the 250-volt direct-current power switchboard to a large-capacity storage battery, which can thus be connected with either of the control systems; but this is only intended for an extreme emergency. It was also felt that a more simplified control layout would result by departing from the three-wire system formerly used, and accordingly a 250-volt, two-wire layout was decided upon, resistors in series with the control lamps being used.

The policy already established in the previous stations of a flexible transmission manhole system was adhered to. In this scheme a series of manholes are built directly in front of the switch house, into each of which a number of the cables from the pothead compartments are extended. In the manhole it is possible to run this cable in any one of a number of ducts laid along the entire length of the switch house and at right angles to those coming from the pothead compartments. Thus any cable can be brought to any compartment in the station, a very helpful layout at times of rearrange-

IN THE VIEW AT LEFT IS SHOWN THE SINGLE-LINE DIAGRAM OF THE RICHMOND STATION AND 66-KV. SUBSTATION

ment of feeder locations such as may become advisable with the growth of the station.

Of particular interest is the 66-kv. outdoor substation. When the generating station has reached its ultimate capacity it will not be economical to transmit more than about half the energy at 13,200 volts, and therefore about an equal amount will go out at 66,000 volts. The construction of this high-tension substation, whose ultimate capacity will be between 500,000 kva. and 750,000 kva., has been begun, as indicated earlier in this article. Two 60,000-kva. transformer banks are installed, each consisting of three 20,000-kva., single-phase, water-cooled units, provided for tap changing under load. They constitute the largest bank for such operation ever built. Taps are changed by means of a control switch in the operating room of the generating station, which simultaneously starts the separate mechanisms on each of the three transformers composing the bank. There is no tie between these mechanisms, and they may or may not operate in unity. Should the various steps that are gone through in changing from one tap to another be taken by the three single-phase transformers at slightly different times, as is apt to be the case, no harm would result; in fact, the voltage change might be somewhat smoother. However, adequate precautions are taken against failure to complete the step in its entirety.

The 66-kv. bus will be laid out in three sections, possibly with reactors between them. To test the 66-kv. cables a 300,000-volt kenotron has been installed. It can also be used to test the lower-voltage transmission cables. A 1,200-kva. testing set, consisting of a regulator and a transformer, is also installed, as well as a Lundin set.

Past Operating Experiences Affect Design of Richmond

Economic Conditions Call for Maximum Efficiency in Operation—Uniformity in Equipment Makes for Safety and Reliability —How Operators Are Trained During Station Construction

By N. E. FUNK
Operating Engineer Philadelphia Electric Company

THE design and operating divisions of the Philadelphia Electric Company have always worked in very close harmony toward the end of producing operating results in the new station designs that will run very close to the theoretical performances as laid down by the design.

Since the new Schuylkill station was put in operation in 1915 the Chester, Delaware and Richmond stations have been designed and constructed. In the meantime economic conditions have changed considerably. The price of fuel, labor, supplies and maintenance materials has doubled, justifying greater refinement in the station design. Likewise tremendous strides have been made by manufacturers in producing equipment that will work through very much greater temperature and pressure ranges. Economizers have been installed where before they were not justified. Air preheaters have been developed which in 1915 were not thought of.

ADVANTAGES OF UNIFORM TYPES OF CONTROL EQUIPMENT

It is readily appreciated by one familiar with the progress in the art that the changes enumerated of necessity require considerable differences in major and detailed design that could easily lead to fairly wide variation from established operating procedures.

Unless great care is observed in design it is easily possible to produce a station that will require a vast amount of training of the operating personnel if the possible efficiencies obtainable are to be closely approached.

It is possible, however, even with the fundamental differences in the types of stations constructed over the last ten years, to keep in mind that the operating personnel of the system should be as flexible as possible in order that men may be transferred from one station to another as the need occurs and be fairly familiar with the operating procedures involved in the particular position which they fill in any one of the stations.

In 1921 the Philadelphia Electric Company printed a set of operating rules with an explanatory text which applied to the stations then in operation. It was attempted to build these rules primarily on sound basic operating practices to which the details could be appended, and it was found that if these operating rules were borne in mind during the design of a new station, it was very easy so to design the station that these rules need not be discarded. In many cases the choice lay between several solutions of a problem which were equally effective but which if left as a matter of choice alone might have been done in a manner that would have changed the operating procedure; in these cases the choice was always made so that the operating routine need not be disturbed.

In laying out control panels for all apparatus the instruments that are common to all stations are located in the same position on the control board wherever this is possible. This causes no inconvenience in the design, does not disturb the appearance of the board and has the advantage of giving the operator the fewest number of new instrument locations to learn.

I know there are many engineers who would consider this more or less inconsequential and that the new station is so different from the older ones that the operator must start from the ground up anyway, and therefore this convenience to him need not be considered. I have found from personal experience, how-

ever, that this idea has considerably more value than many would allot to it, since the man immediately feels more or less at home with the control equipment so much of which is familiar to him.

It may be argued that too close adherence to a plan of this kind is very apt to cramp the design and be the means of installing antiquated equipment. This can never be the case if intelligence is used in applying the basic thought involved.

From the control point of view, probably the greatest difference in apparatus between Schuylkill No. 2 station and the Richmond station is in the boiler room. The Schuylkill station has forced-draft fans supplying stokers and natural draft carrying away the gases from the B. & W. boilers. The Richmond station has forced-draft fans, stokers, economizers, air preheaters and two induced draft fans. Obviously more control apparatus is required for the Richmond boilers than for the Schuylkill boilers. However, the panels are located in the same relative position to the boiler so that four boiler controls are adjacent and the draft gages and Bailey meters are located in the same relative position on the panel. The stoker control is in the same location in both plants as well as the hand-controlled boiler-feed water valve. The damper controls must of necessity be different, since in the Schuylkill plant they are manually operated by levers, whereas in the Richmond plant they are motor operated. An attempt is made in the latter case, however, to locate the electrical control in the same relative position on the board as the manually controlled handles, which are located beside the board in the former case.

Obviously a boiler operator who has been trained in the Schuylkill plant and become used to the control of his boiler will be familiar with the major metering items on his board and know just where to look for them. Likewise at least part of his control is in the same location, so that he has the minimum amount of new equipment with which to become acquainted.

The generator control panels are absolutely identical with the exception of the scale values on the meters. It is of course very easy to do this, since all the control operations are the same, the only difference, so far as the electrical end is concerned, being the size of the unit.

If this same policy is pursued throughout the plant control equipment, it is surprising how rapidly the operating force will fall into the operation of equipment in conjunction with the main apparatus in the plant with which they have been unfamiliar in the past.

This idea promotes the more economical operation of the plant, which I believe is fairly well typified in the fact that three months after the first unit was turned over in the Richmond station the operating force was able consistently to produce results only 3 per cent higher than the theoretical design constants of the station.

Service Reliability Increased

In addition to the economic results produced, no small weight can be given to the greater reliability of the service when the new plant is put in operation with a force that feels at home with the equipment it must handle as compared with an operating force required to feel its way along with strange equipment, the controls of which are in new locations, generally unmarked, and with the possibility, due to the fact that faults may develop in the new equipment or in the work of installation, of uncertainty as to whether it will respond in the manner expected. This uncertainty as to the response of the apparatus to a certain operating procedure exists with any new installation, but if on top of this is placed some uncertainty in the operator's mind as to whether he has the proper control or not, it is not in the realm of imagination to expect more numerous control errors to be made than where this condition of uncertainty has been eliminated.

This idea has been applied throughout the plant in the boiler room, turbine room and electric control rooms. Even in the coal tower we have insisted on having the hoisting equipment controls so arranged that a man can be moved from one station to another and must learn his bucket speed and hoist characteristics only, the controls being as natural to him as those at the station he left. The use of control equipment that is identical from the operator's point of view does not tie the purchase of apparatus up to one manufacturer, since this arrangement can be readily obtained with all hoisting equipment.

Training the Operating Personnel by Contact with the Design Office

For many years it has been the policy of this company so to arrange the time of those men who are going to fill the key positions in the new station that they may spend at least two days a week in the design office while the plans for the new plant design are in progress. This makes it possible to include in the design those operating features that will produce a given result with the minimum of effort. Many details can be worked out in this manner from the operating experience of these men which otherwise might not be given their proper weight and in fact might be entirely eliminated from the design. Many features that in past designs have not been as satisfactory from an operating point of view as might have been the case with slight changes made in the detail of the design can be rearranged for greater convenience in operation or reduction in maintenance costs.

The advantage of having these liaison operating men frequently in the design office is that much time is conserved; as the drawings are being developed these operating ideas may be readily worked into them, whereas if the drawing room completed its detailed design before the operating personnel had the opportunity of making suggestions, then it would be necessary to revise the drawings if the suggestions were worthy of consideration. This of course is an expense of both time and labor and might cause undue delay in the completion of the project. Furthermore, the suggestions of the operating force might produce a somewhat better arrangement of certain details from a general point of view, but one which had no particular effect on convenience or costs, and it is quite possible that if these were made after the drawings had been completed it would be felt hardly worth while to spend the time and cause the delay in changing the drawings.

Thus far attention has been called only to the benefit accruing to the design from this procedure. It must be realized, however, that the key men obtain a tremendous benefit themselves in gradually familiarizing themselves with the design as it progresses so that with the completion of the work they are familiar with all details of the equipment that is going into the plant.

When the design has progressed to a point where construction begins, these same men are turned over to the construction engineer to be used as inspectors of equipment during the erection in the plant.

These men know that they must put the equipment into operation and live with it thereafter. For this reason they are likely to be more critical of the workmanship than if they were through with the job forever once it had been installed and put into operation. They know that they cannot blame the construction force for faulty workmanship in erection if they have allowed it to slip by and that if they are lax in their inspection this laxness will come home to them at a later date in troubles which they will encounter and must overcome themselves.

The procedure here outlined familiarizes the key men with the plant in its entirety from the inception to the fruition of the design in the completed plant. In consequence they are not only intimately acquainted with the characteristics of the plant in all its detail but are also much better equipped to teach the operating force that is built up under them.

The maintenance of all generating and substation equipment has been assigned to a maintenance bureau under the direction of a superintendent. This bureau acts as a contractor to the plant superintendents, who place orders on the maintenance bureau for the repairs to all their equipment. In this manner the maintenance bureau becomes conversant with all types of equipment on the system and has records of the shortcomings in the performance of the apparatus and likewise any changes in equipment design required to reduce the maintenance cost of this particular type of apparatus or to improve its performance characteristics. They are thus in position to point out possible troubles that may be experienced from designs submitted for purchase. For this reason they are called into consultation by the construction department when purchasing the equipment for the plant. In this manner equipment that might otherwise be purchased due to price considerations where all the equipment submitted satisfies the specifications might be turned down due to features that would lend themselves to high maintenance, or the bidder might be required to redesign the particular feature that is objectionable if he desires to be further considered.

The procedure here outlined leads to a very close co-operation among the design, construction and operating divisions of the company. It keeps the design division in close touch with all operating experiences that have been obtained from past designs, instilling the operating men's point of view in their minds much more firmly than would be the case were they not so closely associated, and permits obtaining a final, well-co-ordinated result that we feel is much better than could be obtained without this close co-ordination. By this method of handling, many conveniences in detailed design can be obtained at no additional capital cost, which taken as a whole permits the operation of the plant through its daily load cycle at an efficiency value much closer to the theoretical designed efficiency than would be possible were these considerations neglected.

The ramifications involved in present steam plant practice are so diversified that it is no longer possible for one man to be an authority on all branches, and the best results can be obtained only when specialists in consultation jointly labor to produce the desired end.

Letters from Our Readers

More Details of the Customer-Ownership Movement Should Be Supplied

To the Editor of the ELECTRICAL WORLD:

Since the customer-ownership movement of electric public utilities started a great many articles concerning it have appeared from time to time, including the reports of the National Electric Light Association—all of them splendid and helpful to the cause. Yet of all these articles not one gives an actual detailed history showing tangible results attained. For example, take one of the larger companies, Northern States Power or Cities Service, whose securities are quoted daily. Why should not the exact status of the company at the time of inaugurating customer ownership be made clear, with the condition of public relations, the attitude of the public service commission, the price and number of stockholders and the actual tangible results to date? A chart showing price of stock and number of stockholders would be helpful, as would, too, an account of what happened in 1920, in the big slump, in the way of changes in price of stock and increase or decrease of number of stockholders.

L. F. WIEGAND.

Brooklyn, N. Y.

Saturation and Show-Window Lighting

To the Editor of the ELECTRICAL WORLD:

Referring to an editorial in the April 3 issue of the ELECTRICAL WORLD, it is truly "an absurdity" to talk of saturation, not merely in so far as household electrical appliances are concerned, but more or less generally throughout the entire electrical industry. Take, for instance, one item with which because of intimate contact I am familiar, i.e., show-window lighting. While the number of lamps and reflectors, the conduit and wiring and all the other wiring devices that go to make up a complete show-window lighting installation sold and put into use may run into a stupendous figure, a walk at night around the business streets of any city will indicate to the discriminating observer that here is still a virgin field for the application of the products of the industry. The number of stores that fall short of even the lowest standard of effective window lighting is legion. Moreover, we are at the beginning of a new era in show-window lighting. A new consciousness of the value of light in creating effective window displays pervades the minds of the progressive window-display managers.

For years it has been recognized that the show-window display, in its essentials, is the same as the theater stage setting, but the stage manager has outstripped the window-display man in the effective use of light. The chief reason for this is the meager lighting equipment placed at the disposal of the display manager. To gain stage-lighting effects, show windows must be equipped in a much more complete manner than heretofore. To illuminate windows with a high enough intensity to give to the window its maximum "sales power," to eliminate daylight reflections in the plate glass and to impart the marvelous effects of atmosphere to window displays by the judicious use of colored light requires something more than a few lamps and reflectors strung along the front and top edge of the window.

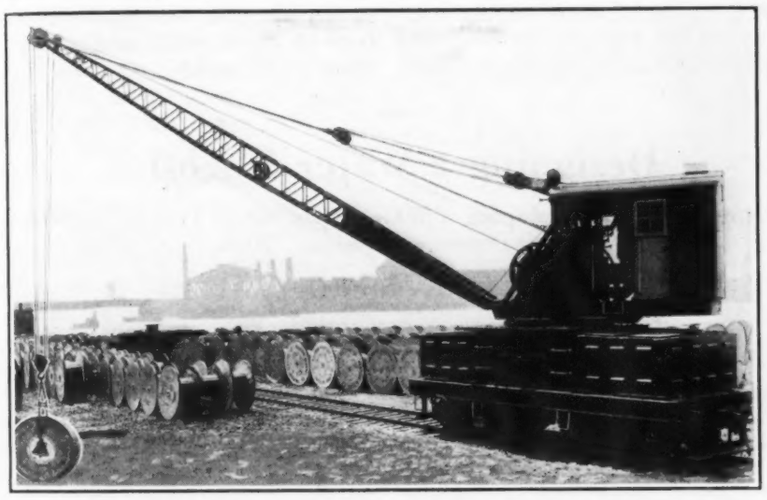
JOHN A. HOEVELER,

Manager Engineering Department Pittsburgh Reflector Company, Pittsburgh, Pa.

Central Station and Industrial Practice

Storage Battery Locomotive Crane Hoist

THE value of storage battery locomotives in yard service has been demonstrated. Already several heavy electric locomotives of this type are in use. Now we have the storage battery locomotive crane hoist, the largest of which was recently placed in service at the Kearny, N. J., plant of the Western Electric Company.



STORAGE BATTERY LOCOMOTIVE CRANE HANDLING REELS OF CABLE

This crane hoist, which was manufactured by the Brown Hoist Company, Cleveland, was installed for the purpose of moving cable reels from point to point around the yard. In addition it draws ash cars back and forth from the ash-handling building to various parts of the yard where ashes are being used for filling in what originally was a swamp.

The hoist was designed to handle a maximum of 150 reels a day over a maximum distance of ten miles. Reels vary in weight from two to five tons each and the average round trip is 500 ft. The maximum number of trips amounts to 100 daily.

The crane weighs 105 tons complete, which is quite a load for a storage battery to move in addition to a freight car of the gondola type, but it does it easily and smoothly.

When hoisting a full load, the operating speed is 60 ft. per minute with a 2-r.p.m. speed when rotating full load on a 50-ft. radius; track travel over level track is 150 ft. per minute. The length of the boom is 40 ft. A 100-hp. G. E. motor operates the boom, whip and travel and a 25-hp. G.E. motor rotates the crane. These motors were of the 250-volt, direct-current, two-commutating, inner-pole switch crane fully inclosed type.

The crane is equipped with a 100-cell, type FL-13 Exide-Ironclad battery, which has 1,080 amp.-hr. capacity, 205 kw.-hr. at the six-hour rate of discharge.

For recharging the battery the hoist is run into the generating plant, where the battery is charged by a 250-volt motor-generator set. With this motor-generator set is a panel containing a 500-amp. Sangamo locomotive type meter with an 1,800-amp.-hr. dial. This is used for recording the charging and discharge of the battery, together with the necessary ammeter and voltmeter. An Anderson three-point charging plug receptacle of 300-amp. capacity is also part of the charging equipment.

A feature of the hoist is the layout or arrangement of the operating mechanism. In so far as it has been possible, levers and foot pedals have been arranged in positions corresponding to those having similar functions in a steam or gasoline engine-operated hoist. Thus an operator accustomed to the latter type of hoist will feel perfectly at home in the newer type storage battery hoist almost from the start.

A voltmeter and an ampere-hour meter are located in the cab beside the operator's place. In the forward part of the cab a scale records the height of the boom from the ground as it travels up and down, and a dial outside but in full view of the operator registers the weight of the load on the boom. Thus the operator can easily ascertain at a glance, without having his attention diverted from his main duty, the exact conditions under which he is operating.

Besides the operator, only one other man is normally required to shift the cable reels from one place to another. This man merely couples and uncouples the huge clevis which, by means of a drawbar, hooks the reels. Complete control of the hoist is maintained at all times by the operator, who can lift or deposit a five-ton cable reel with the nicety of a woman dropping a piece of sugar into a teacup.

Balanced Protection for Station Buses

A NEW and interesting scheme of substation bus protection making use of balanced relays has been developed and put into operation recently by the Bureau of Power and Light of the City of Los Angeles. Balanced relays have been extensively used for line protection, and the results have been very successful, because of the discrimination and instantaneous action of such relays. The station bus has previously

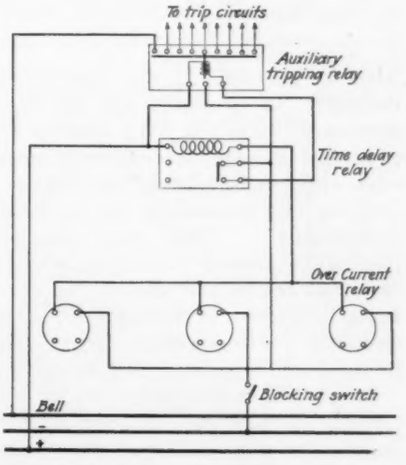


FIG. 1—WIRING OF TRIPPING CIRCUITS USED FOR PROTECTION AGAINST FAULTS ON HIGH-TENSION BUSES

been protected by means of overload relays with considerable minimum time delay.

Even though very little trouble is experienced on station buses, it was felt that because of the great concentration of short-circuit power on the station bus and the possibility of serious damage from short circuits it was desirable to extend the advantages of balanced protection to the station buses.

All stations of the Bureau of Power and Light are equipped with double high-tension buses. The normal procedure is to operate both buses in parallel. It was considered desirable, in event of bus trouble, automatically to relay the shorted or grounded bus in the quickest possible time and to carry the station load on the remaining bus without interruption. This was accomplished by taking advantage of the fact that the vector sum of the currents in a given system is zero. The elements of the scheme are shown in the one-line diagram of Fig. 2.

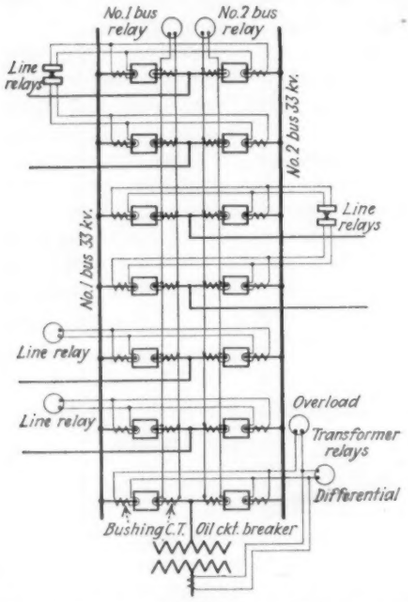


FIG. 2—RELAY SCHEME TO CLEAR EITHER OF TWO BUSES WITHOUT INTERRUPTING SERVICE ON THE OTHER

Circuits are cleared and restored to normal without use of pallet switches on oil circuit breakers.

As shown on this diagram, all oil circuit breakers are equipped with a double set of bushing type current transformers. The transformers between the oil circuit breakers and the buses are used entirely for line protection. The current transformers on the line side of the oil circuit breakers are used for the bus protection. All bus protection current transformers installed on oil circuit breakers on bus No. 1 are connected in parallel to a set of instantaneous overcurrent relays. Likewise the current transformers on the oil circuit breakers on bus No. 2 are connected in parallel to another set of overcurrent relays. Each phase of the three-phase system is so protected. In event of short circuit or ground on either bus, the vector sum of the currents as measured by the current transformers is no longer zero and the overcurrent relays will close their contacts.

The scheme of the tripping circuit is shown in Fig. 1. Between the overcurrent relays and the auxiliary relays that close the tripping circuits to the individual switches is a time delay relay. This relay is instantaneous in closing but has a time delay in opening, and functions to hold the tripping circuit closed for a sufficient time to allow all the circuit breakers affected to open.

Tests have shown this bus protection scheme to be entirely satisfactory. With one or more lines out of service, there will be a small differential current flow to magnetize the dead transformers. However, with only one incoming line, one outgoing line and one transformer bank connected to the bus, this differential current is so small as to have no effect on the relays.

Designing a Water Rheostat

Experiences in Developing a Water Rheostat to Test a 15,000-Kw. Generator at Lansing, Mich.

BY E. T. ANDERSON
Electrical Engineer Board of Water and Light Commissioners, Lansing, Mich.

IN OCTOBER, 1924, an acceptance test was made on the Allis-Chalmers 15,000-kw., 13,200-volt turbo-generator unit at the Moores Park station of the Board of Water and Electric Light Commissioners at Lansing, Mich. At this time the normal load was insufficient for this purpose and it was necessary to construct a water rheostat to furnish the additional load required.

There is a great scarcity of data regarding the operation of water rheostats at high voltage. Acting upon information that was obtained from the ELECTRICAL WORLD and other papers, it was decided to use three 6-in. pipes placed 4 ft. apart at the vertices of an equilateral triangle. These pipes were held apart by a structure of paraffine-coated dry maple two by fours and were arranged so that the pipes could be raised or lowered as desired. The rheostat was installed in the discharge flume of the condenser and connected through a General Electric type H-3 oil circuit breaker to a 10,000-kw. turbo-generator that was isolated from the rest of the system for the preliminary test. This was done so that we could apply the voltages gradually, as we were not sure just how high we could go.

The voltage was applied gradually to the rheostat and at 7,500 volts a heavy discharge took place between the electrodes. This caused a load sufficient to trip the breaker, which was set at 5,000 kw. The electrodes were then spaced out to 8 ft., which placed them about 2½ ft. from the concrete retaining wall. When voltage was applied, there was a discharge at 7,500 volts across the surface of the water to the reinforcing in the concrete. This discharge caused a surge sufficient to open the circuit breaker. After a few more attempts with spacings varying from 4 ft. to 8 ft. it was decided to remove the rheostat and replace it in the river above the dam, where more space was available. Here a new apparatus was constructed, and the electrodes were spaced 20 ft. apart. It was impossible to get above 7,500 volts before the discharge between the electrodes along the surface of the water became so great that the breaker was kicked out.

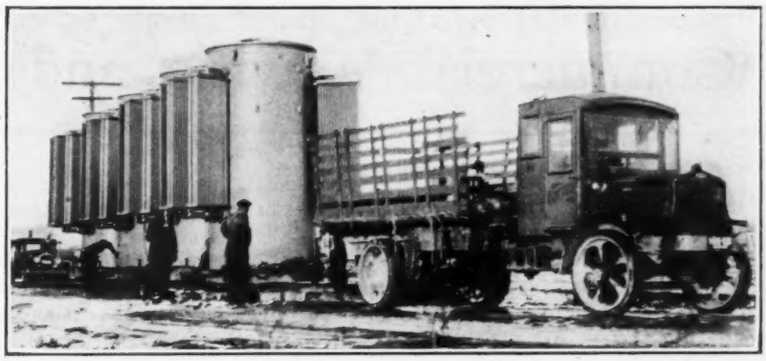
We next replaced the 6-in. pipes with 2-in. pipes with no better results. We then devised what we thought was a really ingenious electrode. An iron pipe about 1 in. in diameter was wrapped with varnish cambric, leaving about 6 in. of the bottom exposed. This iron pipe was then placed inside of a bitumenized fiber duct, which projected about 3 in. above the surface of the water. With this arrangement it was possible to build up a voltage of 13,500 with a load of from 150 to 200 amp.

A small geyser was caused by the heated water rising and shooting up over the top of the fiber duct. This scheme eliminated the surface discharge to a great extent, but it was impossible to hold the load for any length of time. The discharge of the electrodes into the water disintegrated the varnished cambric and it started to unravel. This left too much surface in contact with the water, and the resulting load would open the circuit breakers.

Various other electrodes were tried with poor success. We finally adopted a ¾-in. solid iron rod. This rod was wrapped with rubber tape for a distance of about 20 in., leaving about 10 in. below and 10 in. above the surface of the water. About 4 in. of the lower end of the rod was left bare to make contact with the water. Rubber proved to be a very good substance, as it was quickly solidified by the heat and this forced the action to take place at the end of the rod. By experimenting, we found that immersing the bare end of the rod to about 12 in. gave the best and most uniform results. Further immersion caused violent bubbling due evidently to the formation of large quantities of gas under the water. These bubbles would rise along the rod to the surface of the water and explode, causing quite an electrical disturbance and display and a great variation in the load. It was necessary to space the electrodes 41 ft. apart, and at this spacing we could get a load of 5,500 kw. at 13,200 volts. Under these conditions the rods would last approximately five hours before they were eaten through, and they were always eaten through at the point where the rubber insulation ended. The load was very well balanced and when connected in parallel with the load on the 13,200-volt grounded neutral system there was practically no disturbance. Several factories discharge some of their waste liquids into the river, which is probably the reason for the wide spacing that was required.

The test had its scenic and spectacular side as well as the utilitarian side. The discharge from the electrodes was of a dark lavender hue, and was very beautiful to see. It emitted a hum similar to that obtained in an electric arc furnace where the arc breaks upon the molten metal, and was audible for a distance of more than 200 ft.

Fish that were caught between the electrodes when the current was turned on immediately went to their "Happy Hunting Grounds." Those that were outside of the triangle but not far away from the electrodes seemed to be knocked unconscious. They would float away with the current, but in a few minutes they would generally come to and dart away. Those that were outside of the triangle but somewhat further away acted as if they had lost control of their muscles. As they floated further and further away from the sphere of magnetic influence they would gradually regain control of their bodies and swim away.



PULLING TRANSFORMER ALONG TRACK BY MEANS OF WINCH TRUCK AND SINGLE SNATCH BLOCK

Moving Four 30-Ton Transformers

WHEN the new 10,000-kva. Greenfield substation of the Ohio Public Service Company was constructed at Sandusky, Ohio, unloading and hauling the four 3,333-kva. transformers, each weighing 30 tons, presented a considerable undertaking, as they were to be installed about half a mile away from the railroad. The method used to move the transformers from the railroad siding to the substation is well shown in the accompanying illustrations.

Fortunately hard surface roads were encountered throughout the haul. Two 30-ft. sections of railroad track were laid on the road and the four transformers were unloaded from the cars and placed upon the tracks on their own permanent trucks. A five-ton truck equipped with a winch and single snatch block was used to pull each transformer, which was moved approximately 30 ft. over the two sections of track. After each 30-ft. haul the section of track uncovered was skidded around to the end toward the substation and the operation was repeated.

The transformers were moved at an average speed of about 100 ft. per hour and about twenty hours was required to move all four transformers the full distance after they were under way. This method of moving heavy transformers was no more costly than any other method that might have been used and was probably somewhat cheaper.

MOVING 30-FT. SECTION OF TRACK AHEAD

Commercial Activities and Public Relations

Duplicate Service in Boston

TERMS and conditions under which duplicate service is supplied by the Edison Electric Illuminating Company of Boston, Mass., were outlined by C. A. Corney of the electrical engineering department at a recent meeting of the technical section, New England division, N.E.L.A. In the general practice of the company the customer pays for duplicate service, with the exception of customers who are usually provided with loop service. This comes about through the practice of cutting a high-tension cable line and extending both ends into a high-tension customer's substation, which assures service in the event of these lines being out of commission.

There are, however, certain classes of high-tension customers, principally those contracting for off-peak service, who are provided only with a single line, which is tapped from the nearest cable or which may run direct from a near-by substation. There are certain classes of low-tension customers located in the direct-current territory whose load requires more than one group of service cables, and these are furnished by the company with a sufficient number of service cables so that should one set of a group fail those remaining would be sufficient to carry the load. Such customers include theaters, office buildings, department stores and newspapers. This practice is considered necessary on account of the semi-public character of their business. Most local regulations require emergency service of a certain character for theaters regardless of the location or type of service.

If a customer desires the company to provide duplicate service or to furnish special capacity in other ways, the rate schedules of the company establish a charge ordinarily of $1 per kilowatt per month in addition to the charges of the rate under which the service is supplied and in addition to any installation charge.

Duplicate primary lines are supplied to cities and towns buying energy from the company in bulk and distributing it locally over their own lines. Where a city or town is served directly by the company, this service is usually rendered at distribution voltage over several distribution circuits. These circuits are liberally provided with tie switches so that in the event of one circuit being out of service the remaining portions may be energized from other circuits by means of these tie switches. These facilities appear to meet local conditions very satisfactorily.

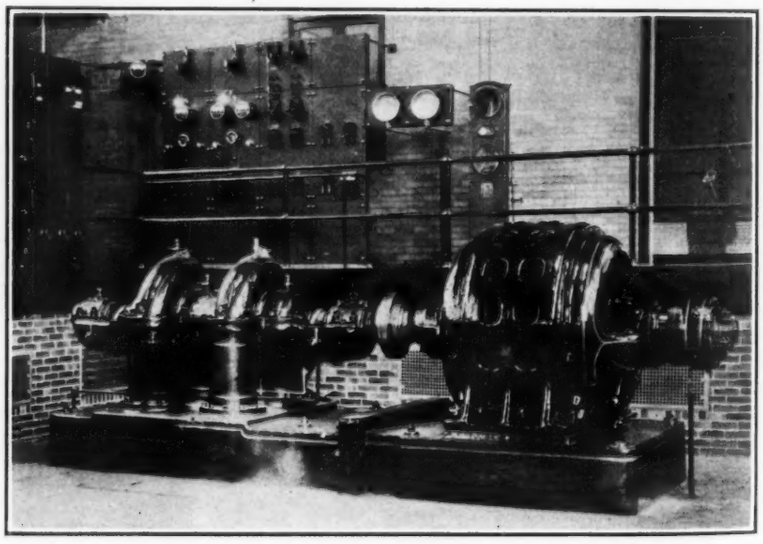
As large industrial customers are usually served from high-tension lines, they are provided with duplicate service in general except as they may contract for off-peak service. There are some exceptions to the foregoing general principles, but they represent the generally accepted practice of the Edison Electric Illuminating Company.

Synchronous Motor-Driven Pump Shows High Efficiency

MUNICIPAL water systems are finding it generally more practical to use electrically driven pumps rather than to increase existing steam equipment when additional pumping capacity is required. This practice was followed by the Water Department of Erie, Pa., recently in the installation in its main pumping station of a motor-driven pump to supply high head service. The new unit consists of a two-stage centrifugal pump, having a 24-hour capacity of 12,000,000 gal. at a maximum head of 392 ft., driven by an 1,100-hp., 2,300-volt, 1,200-r.p.m. synchronous motor operating at unity power factor designed and installed by the Allis-Chalmers Manufacturing Company.

One of the factors influencing the decision for electric operation was economy in floor space in the pumping station; the new unit occupies less than half the space formerly taken up by a steam-driven pump having a daily capacity of only 6,000,000 gal. Thus space is available for still another electric unit of the same size.

The incoming main power and motor panels are located in one corner of the pump room on a balcony just above the new pump. A direct-current switchboard formerly occupied this space, but was moved to make room for the new panels. Gages and flow meters for the electric pump can be seen to the right of the switchboard shown in the accompanying illustration.



12,000,000-GAL. CENTRIFUGAL PUMP DRIVEN BY 1,100-HP. SYNCHRONOUS MOTOR IN ERIE PUMPING STATION

An efficiency test was conducted

on this unit in January by the manufacturer and the J. N. Chester Engineers, consulting engineers for the Water Department. The output of the pump was measured by means of a 20x13-in. Venturi meter located in the discharge line in the basement.

Electrical measurements were made with two single-phase wattmeters, two ammeters, one voltmeter and the necessary instrument transformers. All of the instruments were calibrated on the day following the test at the laboratories of the Erie Works of the General Electric Company.

The discharge pressures were measured with the 10-in. gage furnished with the pump, and the suction pressures were taken with a mercury column. During the test it was observed that the suction head was slightly greater than was expected in the specifications.

The results of the test as compared with the guaranteed figures of the manufacturer were as shown in the table below.

It will be noted from the test results that the actual over-all efficiency at the rated head of 392 ft. was 80.6 per cent, or 2.2 per cent higher than the guarantee. The capacity of the pump at this rated head was 12,900,000 gal. daily, or 7.7 per cent above the guaranteed capacity.

At the existing head of 376.9 ft. the pump delivered 13,640,000 gal.

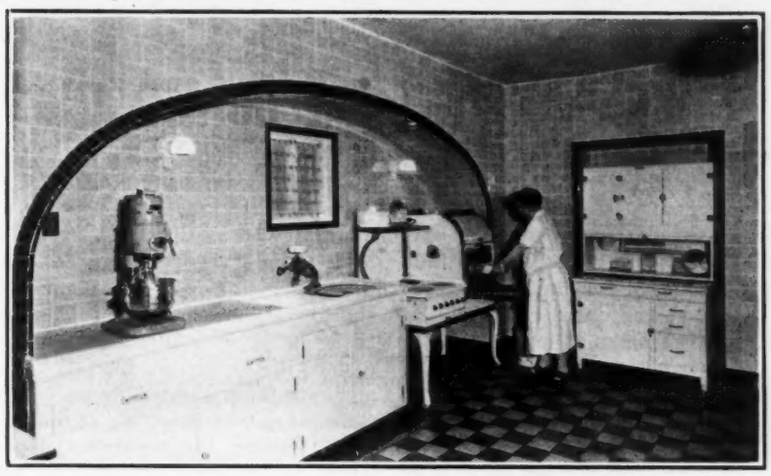
	Guarantee	Result Test
Efficiency at specified head of 392 ft. and specified capacity of 12 MGD., per cent	78.4	80.6
Capacity at specified head of 392 ft., MGD.	12	12.9
Efficiency at existing head of 376.9 ft., per cent	....	78.4
Capacity at existing head of 376.9 ft., MGD.	....	13.64
Power factor	Unity	Unity
Brake horsepower at specified head	....	1,060
Brake horsepower at existing head	....	1,107

of water daily at an over-all efficiency of 78.4 per cent, which was the guaranteed efficiency at the rated head.

This new electric unit was installed to furnish additional reserve capacity and is now operated during the night on off-peak hours. The remainder of the pumping equipment is steam-driven and includes one 20-MGD. vertical triple expansion unit, one 8-MGD. cross-compound horizontal unit, and one 20-MGD. turbine-driven centrifugal pump.

The installation of the new pump was made under the supervision of James S. Dunwoody, superintendent of the Water Department.

What Woman Would Not Covet This Kitchen?



THROUGH the courtesy of manufacturers of electrical appliances, the Bureau of Power and Light in Los Angeles was enabled upon the opening of its splendid new showrooms in the basement of its building, 207 South Broadway, to put on an exceedingly fine up-to-date electrical appliance display. L. E. Moselle, in charge of the electrical appliance sales, and his assistant, A. W. Elliott, now have for their display room the entire basement of the building. It has been completely rebuilt and designed expressly for an appliance salesroom. This picture shows the model kitchen, containing the very latest of electrical labor-saving devices.

Manufacturers' Co-operation Helps Appliance Sales

THE Southern Division of the Illinois Power & Light Corporation has used the aid of manufacturers in selling appliances with marked success. The company's territory consists of about 100 towns, in size from 25,000 to 500, with about 40,000 customers. After standardizing on the makes of major appliances to be handled, the company asked the manufacturers to put representatives in the territory to work with the company's salesmen. Their salaries and expenses are paid by the manufacturer, but their work is routed and directed by the division sales manager. They are men of the highest type and long experience with the products they represent and have a thorough knowledge of modern sales methods. By constant association with the salesmen, they keep them "sold" on their product and by their knowledge of actual field conditions are of great help in improving sales methods. One of the concrete benefits of their work with the sales force is in closing difficult sales and in coaching the local salesmen in the best methods of breaking down sales resistance on different appliances. Representatives of range, refrigerator, washing machine and vacuum cleaner manufacturers are now in the field working in this way.

The company also uses manufacturers' stocks of major appliances for display purposes in its 38 district and local offices. This fits in with the manufacturers' scheme of national advertising, particularly since many of the company's stores are located on well-traveled national highways. The company estimates that by agreeing to display these appliances constantly, it is able to reduce its stock of these appliances 10 per cent. Due to the scattered territory, necessitating carrying stock in twelve district storerooms, it had been difficut to get much better than three turnovers a year, so this reduction has been of exceptional benefit in the black ink of the monthly sales statement.

Doubling Commercial Lighting Revenue

OFFERING of free consulting service, trial installations, exemplary use of lighting, sign-maintenance service, demonstrations and co-operation with architects and builders have doubled the commercial lighting revenue of some individual lighting customers in towns of 8,000 to 10,000 population in South Dakota, according to Robert Geid, Northwestern Public Service Company, Huron, S. D. Personal letters were mailed to selected commercial and business houses in these small

towns, indicating how improved lighting could be utilized to stimulate more business and offering free advisory service. It is most important, however, points out Mr. Geid, to follow up promptly the requests for this lighting service. This advisory service is rendered by the utility regardless of who furnishes the equipment.

Trial installations of lighting have been found most effective in stimulating increased consumption and in no case have they been removed. By applying the most effective lighting to its own offices, shops and buildings, utilities can demonstrate what can be done by others. Many electric signs are only partly used or allowed to remain unused because of inadequate maintenance, contends Mr. Geid. Consequently this company offers a sign-maintenance service to stimulate the maximum use of the signs.

By getting in touch with the owners and the architects of buildings before they are built or designed, it has been found possible to secure the adoption of many ideas in lighting that would be more difficult to sell or apply after the building is completed.

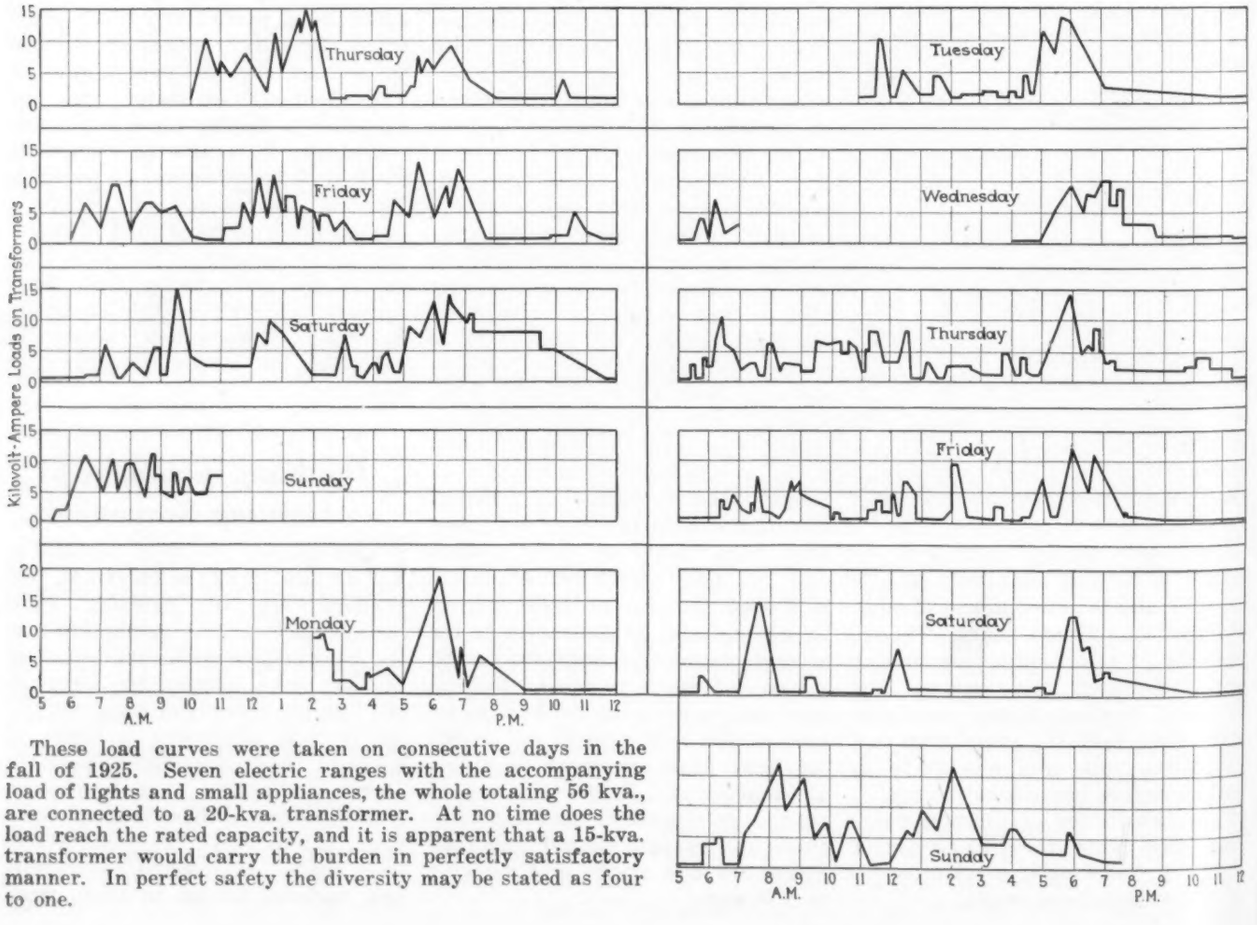
Hints on Utility Merchandising

SOME methods have been used in utility merchandising by the Kansas City Power & Light Company of Kansas City, Mo., that have been found very valuable, according to C. F. Farley, vice-president in charge of merchandising. Among these have been utilization of uniformed meter men as appliance salesmen, spending the profits on energy-consuming devices in stimulating sales, leasing the appliance departments to dealers and featuring portable lamps in the display room.

All meter men have been equipped with distinctive uniforms to relieve any customer's apprehension regarding whether they should be allowed to enter their homes or not. As a result these meter men, who are used as part-time appliance salesmen, are able to get into 50 per cent more homes than the regular salesmen.

The primary purpose of the utility merchandising department is to increase the revenue from energy, and this with appliance sales at a profit. However, the profits on revenue-producing appliances can be advantageously spent in stimulating their sales, declared Mr. Farley. Nothing is done that could be detrimental to dealers, as all appliances are sold on a profit-making basis. During poor-demand seasons, however, appliances are sold on the installment basis, without carrying charges in some instances. As an indication of the co-operation with dealers, the various departments of the merchandising division of the company are leased to different dealers, who are required to live up to certain standards of practice. Certain articles require specialists, and these the utility furnishes. Radio equipment is sold, because the utility knows that its use increases the burning of domestic light in addition to increasing the consumption from storage-battery charging. Portable lamps are favored as they have both display value and rapid turnover.

Daily Range Load on 20-Kva. Transformer



These load curves were taken on consecutive days in the fall of 1925. Seven electric ranges with the accompanying load of lights and small appliances, the whole totaling 56 kva., are connected to a 20-kva. transformer. At no time does the load reach the rated capacity, and it is apparent that a 15-kva. transformer would carry the burden in perfectly satisfactory manner. In perfect safety the diversity may be stated as four to one.

Digest of Electrical Literature

Generation, Control, Switching and Protection

Economy in Parallel Operation of Power Stations.—W. BORGQUIST.—A general discussion of the advantages of parallel operation between steam and water-power stations.—*Teknisk Tidskrift* (*Swedish*), *Elektroteknik*, March 6, 1926.

No-Load Copper Eddy-Current Losses.—THOMAS SPOONER.—A digest of this A.I.E.E. midwinter convention paper may be found in the ELECTRICAL WORLD for Feb. 20, 1926, on page 396. *Journal of A.I.E.E.*, March, 1926.

Illumination

Studies in the Projection of Light.—Part XIX.—Design and Analysis of a Sectional Mirror.—FRANK BENFORD.—Earlier parts of this serial have been noted. Since the size and form of the lamp filament have considerable influence on the design of the sections of a mirror, the author proceeds analytically on the assumption that the distribution is intermediate between that from a line source and that from a spherical source. The analysis leads to the surprising conclusion that the irregularities in the approximately plane surface of the glass actually cause an increase, which may be as great as 10 per cent in the intensity of the beam over what it would be were the surfaces true planes. This conclusion is borne out by tests.—*General Electric Review*, March, 1926.

Electrophysics, Electrochemistry and Batteries

Theory of Absorption in Solid Dielectrics.—V. KARAPETOFF.—An abstract of this paper was published in the ELECTRICAL WORLD report of the A.I.E.E. midwinter convention, Feb. 20, 1926, on page 394.—*Journal of A.I.E.E.*, March, 1926.

Electromagnetic Forces on Conductors Near Iron.—B. HAGUE.—In a recent paper the author determined from first principles the distribution of the magnetic field produced by straight conductors in an air space bounded by highly permeable iron masses with plane surfaces. In this article formulas are developed by which calculations can be made of the magnitude and direction of the forces acting on those conductors. While alternative methods are used in some instances, it is shown that since the iron (assumed infinitely permeable) in the neighborhood of a conductor can be replaced by a second wire carrying an equal current in the position of the optical image of the first, with reference to the iron surface, the forces can be computed as for parallel conductors. This applies also when the given conductor is between two iron faces and an indefinite series of images would therefore be set up. Thus for a single wire h cm. from the iron the force per centimeter of wire is $F = i^2/h$ toward the face of the iron. The current is taken in absolute c.g.s. units and the force in dynes. For a wire between two parallel faces l cm. apart, the wire being h cm. from one of them, it is $F = \pi\, i^2/l \cot \pi h/l$ toward the nearer boundary. More complicated formulas express the relation for two parallel wires with currents in the same or in opposite directions in a parallel-faced gap.—*World Power*, March, 1926.

The Photo-Electric Cell as a Smoke Detector.—S. H. REYNOLDS.—The current emitted by the light-sensitive coating in a photo-electric cell is very small, being only a fraction of a microampere. This feeble current can, however, be applied to an amplifying vacuum tube, from which in turn sufficient current can be drawn to operate a relay. A combination of the two elements in the same vacuum bulb is shown diagrammatically in the accompanying figure. The high negative grid bias ordinarily prevents the passage of current between filament and plate. If light falls on the sensitive coating, electrons are given off and go to the collector attached to the plate (shown in the figure by a loop above the plate). The current, though small, produces a voltage drop in the high-resistance grid circuit sufficient partly or wholly to neutralize the grid bias. This permits a current to flow in the plate circuit, actuating the relay. As a smoke detector the cell is so set up that a beam of light falls on it continuously unless obstructed by smoke.—*Electric Journal*, March, 1926.

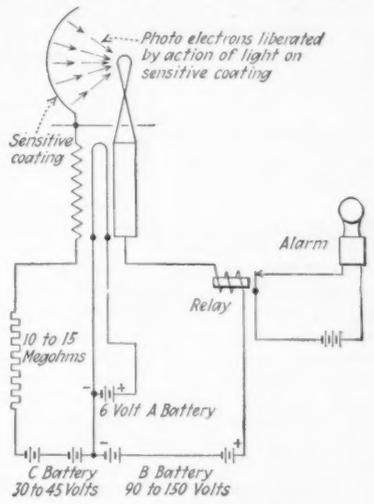


Photo electrons liberated by action of light on sensitive coating
Sensitive coating
Alarm
Relay
10 to 15 Megohms
6 Volt A Battery
C Battery 30 to 45 Volts
B Battery 90 to 150 Volts

DIAGRAM OF CONNECTIONS FOR SMOKE DETECTOR

Motors and Control

Electrification of Paper-Making Machines. — STEPHEN A. STAEGE. — The paper-making machine in its usual form consists of a number of sections which are independently driven but which must be accurately maintained at the proper speed relations to each other. The unavoidable slight elongations or shrinkages of the material necessitate corresponding differences in the speeds of the different sections, which must be achieved without breaking the delicate web. In addition, there must be a wide range of adjustment for the machine as a whole. The present paper reviews the advantages of electric drive and traces the developments that have taken place. Special attention is devoted to a system of direct-current drive making use of a differential field control acting on the individual motors. The speed reference is a master set consisting of a master frequency generator driven by a direct-current master motor of controlled speed. The master frequency determines the speed of synchronous motors governing the section motor speeds through coned pulleys permitting adjustment for the "draw" of the paper.—*Journal of A.I.E.E.*, March, 1926.

Heat Applications and Material Handling

Cooking by Induced Currents.—A new form of electric cooker is described in which the heat is developed in the walls of the cooking vessel itself. The device is a special form of transformer, the windings being incased in a housing above which a part of the laminated core projects. Suspended above a gap in this core is a laminated iron keeper which forms part of the magnetic circuit and which is depressed by a spring to clamp the utensil in place by means of a flat copper bar fixed to the bottom of the latter, so closing the secondary circuit. An efficiency of 85 to 92 per cent is claimed. No figures are given for the power factor.—*Electrician* (*England*), March 19, 1926.

Flames of Atomic Hydrogen.—IRVING LANGMUIR.—*Atomic Hydrogen Arc Welding.*—R. A. WEINMAN and IRVING LANGMUIR.—*Arc Welding in Hydrogen and Other Gases.*—P. ALEXANDER.—When a piece of tungsten wire is heated to incandescence in a vacuum by an electric current the heat is dissipated almost wholly by radiation; if an inert gas is introduced into the bulb, a relatively large amount of heat is in addition carried away by conduction and convection; if the wire is heated in hydrogen, this second heat loss varies as with other gases only up to a temperature of about 1,700 deg. K. and then increases much more rapidly. Thus between 2,600 deg. and 3,400 deg. K. the heat carried away by hydrogen at atmospheric pressure increased with the 5.0th power of the absolute temperature. This abnormal behavior of hydrogen suggested that at high temperatures the molecules are dissociated into atoms, the dissociation absorbing heat, which is in turn liberated by recombination at a distance from the wire. The first of the three companion articles under review approaches this question on the theoretical side and then describes experiments in which a jet of hydrogen was directed into a 20-amp. arc between tungsten electrodes; the flame produced by the "burning" hydrogen where it returns to the molecular form would have a temperature computed to be about 4,000 deg. K. if the atomic form were at room temperature to begin with, but since the dissociated gas is actually much hotter as it escapes from the arc,

the flame temperature is correspondingly higher. The second article deals with the practical application of process to the welding of metals, taking advantage of the very rapid application of heat and the exceedingly high temperatures attainable. One of the advantages of the use of hydrogen is the bathing of the heated parts of the electrodes and the work in the gas, thus preventing oxidation and the introduction of nitrogen. Moreover, it is possible to make good welds between other metals than iron or steel, e.g., aluminum and nickel, chrome-nickel alloys, silicon copper and invar. The third article describes welding with ordinary metallic electrodes and with carbon electrodes in an atmosphere of hydrogen alone or in combination with or other gases, the resulting welds being much more ductile than those made in air.—*General Electric Review*, March, 1926.

Units, Measurements and Instruments

Hot-Spot Temperature Measurement in Alternating-Current Generators.—S. L. HENDERSON.—Common methods of measuring machine temperatures are by thermometer, by change of resistance and by the use of embedded detectors. Only the last named gives local temperatures at selected points on the windings. The arrangement of detectors, both of the resistance and of the thermocouple type, with the associated equipment, is described in this article.—*Electric Journal*, March, 1926.

Traction

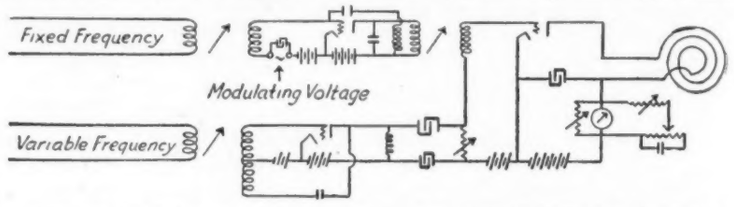
Diesel-Electric Develops Great Power.—A two-and-one-half page illustrated article gives data on a Diesel-electric locomotive recently constructed by the Baldwin Locomotive Works, which has handled 1,000-ton trains on a 40-mile run, three-fourths of it on grades of 0.7 per cent. The average fuel consumption was 3.3 gal. for 1,000 gross ton-miles, with an average speed of about 16 m.p.h. A summary of the principal dimensions follows: Weight on drivers, 180,000 lb.; total weight, 275,000 lb.; locomotive length, 30 ft. 4 in.; engine, twelve-cylinder two-stroke-cycle, 1,000-hp.; generator, 750 kw., direct-current; motors, four, 200 hp.; capacity of tanks, 750 gal.; length over couplers, 52 ft. 1¾ in.; diameter of wheels, 40 in.—*Railway Review*, Feb. 27, 1926.

Multiple-Unit Cars for Illinois Central.—W. M. VANDERSLUIS.—This article deals with the design, operation and maintenance of equipment to be used on the Illinois Central Railroad. It contains a large amount of data on the new cars. Reference to this equipment, taken from other sources, has previously been made in the Digest.—*Railway Age*, March 13, 1926.

Diesel-Electric Tugboats for New York Central.—Two Diesel-electric tugboats have been ordered by the New York Central, each 108 ft. long, with a maximum width of 26 ft. Other data are as follows: Two four-stroke-cycle, six-cylinder engines each direct-connected to a 270-kw., 240-volt direct-current generator; motor, 650-hp., 115/140 r.p.m., 480 volts, shunt-wound, with double armature. In addition there is a 30-kw. generator for excitation, lighting and operation of auxiliaries and a fire pump.—*Railway Age*, Jan. 23, 1926.

Telegraphy, Telephony, Radio and Signals

Method for Generating and Measuring Very Weak Radio-Frequency Currents.—WALTER VAN B. ROBERTS.—For such measurements as that of the over-all radio-frequency voltage amplification, for example, of a radio set, a source of radio-frequency currents of extremely small but fairly accurately known magnitude is desirable. To avoid the usual process of generating currents large enough to be measurable on an alternating-current instrument, and then attenuating, a scheme is offered whereby small currents are generated directly and are measured in terms of a proportional direct current on a microammeter. It is based on the fact that when two simple harmonic electromotive forces are impressed in series on a circuit containing an asymmetric conductor the resulting current contains, among other components, one of zero frequency (direct current) and one of frequency equal to their difference. Under certain conditions a simple relation exists between the magnitudes of these two components, hence the last-named can be known from measurements of the first. One of the frequencies is, in practice, kept constant at 3,000 kc., and the other is varied so as to give a range of beat frequencies around 1,000 kc. By calibrating the couplers it is possible to reduce the current to about a thousandth of the minimum that could be read on the microammeter, that is, to about a thousandth of a microampere. One of the circuit arrangements is here shown.—*Journal of Franklin Institute*, March, 1926.



CIRCUIT FOR GENERATING AND MEASURING WEAK RADIO FREQUENCY CURRENTS

Transatlantic Radio-Telephone Transmission.—LLOYD ESPENSCHIED, C. N. ANDERSON and AUSTIN BAILEY.—This 50-page paper, though in the nature of a preliminary report upon results thus far obtained in the study of long-wave transmission in both directions between the United States and England, shows the great progress that has already been made in the analysis of conditions affecting transatlantic communication. Diurnal and seasonal variations have been plotted from 40,000 observations and examined with reference to the variations in sunlight between the stations, not only at the earth's surface along the great circle connecting them but in the upper atmosphere as well, where on account of the grazing rays there may be light while the ground is still in darkness. Some of the conclusions drawn from the mass of data and the numerous charts are: (1) Solar radiation is the controlling factor in determining diurnal and seasonal variations in the signal field. (2) Transmission in the region bordering on the division between the illuminated and the darkened hemispheres is characterized by increased attenuation; this manifests itself in the sunset and sunrise dips, in the decrease in the persistence of high night-time values in summer and in the decrease in daylight values during the winter. (3) Definite correlation has been found between abnormal radio transmission and disturbances in the earth's magnetic field. (4) The limit of the high night-time value of the signal field strength is essentially that given by the inverse-square law. (5) The major source of long-wave static, as received in both England and the United States, is indicated as being of tropical origin. (6) In general, the static noise is lower at the higher frequencies; the difference between day and night static is apparently due largely to daylight attenuation. (7) The effect of the static noise in interfering with signal transmission is found to be generally similar on both sides of the Atlantic. (8) Directional receiving antennas of the wave antenna type show an average improvement in the signal-to-static ratio of about five as compared with loop reception.—*Proceedings of the I.R.E.*, February, 1926.

Miscellaneous

Healing of X-Ray Cancer.—X. DEBEDAT.—Many doctors and scientists who have to expose themselves daily to X-rays are suffering under more or less severe attacks of local cancer, particularly on their fingers. The author was a victim of this disease himself, and he describes in this short article a new healing method which is said to have proved infallible so far, even in well-advanced cases. He submitted to a diathermo-coagulation method, developed by Dr. Bordier in Lyons, France, with the result of immediate cessation of pains, the stoppage of lymph segregation after three days and complete drying and healing after six weeks. A hardly visible scar was left, with sensibility and circulation unimpeded.—*Revue Générale de l'Electricité*, March 6, 1926.

Electrical Developments in Connection with Mining Work in the Transvaal.—H. J. S. HEATHER.—Indicated as the first of a series on "Power Throughout the British Empire," this paper traces historically the application of electric power to gold mining in South Africa from the time of the electric lighting of the Cape Town docks in 1882.—*World Power*, March, 1926.

News of the Industry

Edison for Atlantic City

Inventor's Presence at N.E.L.A. Convention Expected—William A. White Will Speak

AS THE ELECTRICAL WORLD goes to press word comes that Thomas A. Edison, departing from his custom of years in not appearing at conventions or large public gatherings, will in all probability attend the Atlantic City convention of the National Electric Light Association to be held on May 17 to May 21. He will be made the chief guest of honor. Another famous attendant will be William Allen White, editor of the Emporia (Kan.) *Gazette*, who will speak on the morning of May 20. Owen D. Young, chairman of the board, General Electric Company, will make the chief address at the public policy evening meeting. Secretary of Labor Davis, Guy E. Tripp, chairman of the Westinghouse board, and A. G. Patterson, president of the National Association of Railroad and Utilities Commissioners, are expected to speak during the sessions. Samuel Insull, Alex Dow, John W. Lieb, Sidney Z. Mitchell, F. T. Griffith, W. C. L. Eglin, Henry L. Doherty and R. H. Ballard are a few of the many prominent utility men also on the program, an outline of which will be printed next week.

Savings Bank Investment Bill Fails in New York

Among the legislation which was abandoned at Albany during the closing days of the session adjourned last week were the Mastick-Sargent bills authorizing savings banks to invest under certain conditions in the securities of electric, gas and telephone companies. The Sargent bills passed the Assembly but were never reported from the rules committee of the Senate, while the Mastick bills remained in the Senate committee without action. There seemed to be an idea among legislators that the bills were full of "dynamite" and that they had some bearing on hydro-electric plants and applications for permits to develop power on the St. Lawrence and Niagara Rivers. The Republican leaders, going into a gubernatorial campaign in which water-power development and public utility regulation are likely to play a large part, did not wish to jeopardize the party's position by the passage of legislation which might conceivably be used by the executive for campaign material against them. It was also thought wise to go a little slowly in so important a matter as changing the policy of the state in relation to investments of savings banks.

Two bills of public utility interest which were passed by the Legislature and are now in the hands of the Governor were one to amend the penal law relating to interference with gas, electric or water meters so as to make the existence of devices for tampering with registration presumptive evidence of fraud and one to allow the Public Service Commission to extend for five years the time during which railroads must electrify their tracks in New York City. The Governor is expected to veto the latter.

Control of Duke-Price Saguenay Interests Passes

Unconfirmed statements previously made with some show of authenticity to the effect that the Duke-Price power interests on the Saguenay River in Quebec were to be sold to the Aluminum Company of America and the Shawinigan Water & Power Company were substantiated this week by the announcement that the Aluminum Company of America is acquiring 53⅓ per cent of the capital stock of the Duke-Price Power Company and the Shawinigan Water & Power Company 20 per cent, which leaves a balance of 26⅔ per cent in the hands of the Duke-Price interests.

The Aluminum Company is spending $15,000,000 on its plant at Arvida, 20 miles from the power company's dam on the Saguenay River. It is expected that the Arvida plant will be consuming 100,000 hp. by October. The Shawinigan Water & Power Company, which serves 50 communities, including Montreal and Quebec, is spending about $4,000,000 on a transmission line to connect with the Saguenay River plant. Price Brothers who are among the world's largest newsprint manufacturers, have their main plants near the plant by which their mills are served.

New Permit Granted at Albany to Lower Niagara Company

The New York State Water Power Commission on Wednesday granted an amended preliminary permit, to run until July 1 of this year, to the Lower Niagara River Power & Water Supply Company, which was accepted by the company. Under the provisions of this permit the Niagara company will be able to make an engineering investigation into the feasibility of the use for power development of 19,725 cu.ft. per second of American water in the lower Niagara gorge. This amount is under the 20,000 cu.ft. limit set by international treaty and represents a contemplated second use of water utilized at the Falls.

The essential difference between the permit offered to the company last fall and the one accepted yesterday is the omission of a clause contained in the original permit to the effect that if the company accepted the permit it might not accept any license from any other authority which contained any provisions inconsistent therewith.

Southeastern Men Gather

Governor of North Carolina and Many Prominent Utility Representatives Address Pinehurst Meeting

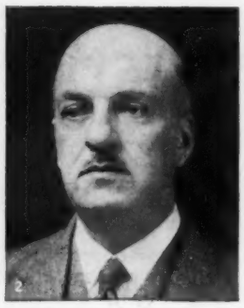
MEETING at Pinehurst, N. C., with an attendance of more than 250, the fourteenth annual convention of the Southeastern Division of the N.E.L.A., which was held on Tuesday to Thursday of this week, was entirely successful. President R. L. Lindsey dealt ably with the aims and activities of the association, and the Governor of the state, Angus W. McLean, told what the development and application of electrical energy had done to bring about its industrial growth.

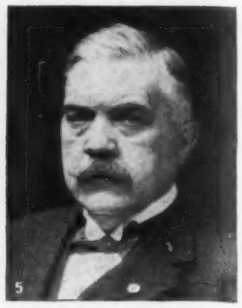
"Co-operation of Educational Institutions with Public Utilities" was the subject of an address by Prof. Frank Capps of the North Carolina State College, who showed how the experiment station is really a research laboratory for industry and said that industries should bring their problems to it for solution. In the North Carolina State College certain courses on "industrial electricity" have been worked out in conjunction with one of the power companies, with two hundred employees enrolled.

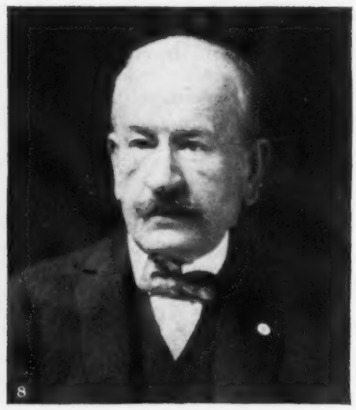
On Tuesday evening there were parallel sessions of the Technical, Commercial and Accounting Sections. Chairman W. E. Mitchell, C. F. Hirshfeld, chairman of the National Technical Section, and E. C. Stone, chairman of the national apparatus committee, addressed the technical session. Before the Commercial Section, under Chairman W. R. Sammons, D. J. Finn of the Edison Lamp Works, J. C. Martin of the Atlanta Electrical League and E. A. Graham of the Servel Corporation spoke. The Accounting Section, under Chairman H. M. Pace, discussed complaints of high bills, allocation of overhead charges to merchandise accounting and sales.

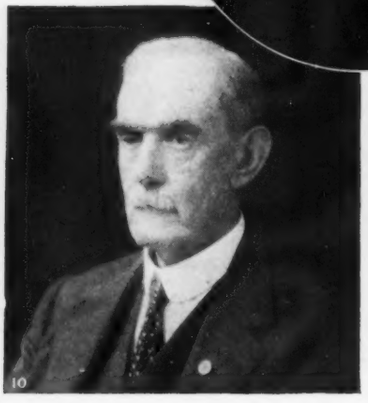
Dr. E. A. White, chairman of the national committee on rural electrification, opened the Wednesday morning session and outlined the work that is being done in several of the Southern States. Other speakers were N. T. Guernsey, vice-president and general counsel of the American Telephone & Telegraph Company; W. H. Onken, editor of the ELECTRICAL WORLD; Girard Harris, editor of the Birmingham *News*; A. J. Maxwell, member of the North Carolina Corporation Commission, and Mrs. Mary M. Bushnell, chairman of the Southeastern women's committee. The women's public speaking contest was won by Miss Lucy Bouchelle of the Alabama Power Company.

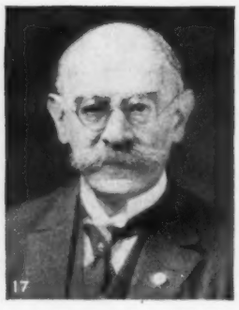
M. H. Aylesworth and M. S. Sloan addressed the annual banquet on Wednesday evening. On Thursday the convention was addressed by P. H. Whiting of H. L. Doherty & Company and by William L. Goodwin of the Society for Electrical Development.











Delegates at Plenary Meeting of International Electrotechnical Commission

1. C. Hoenig, Switzerland. 2. E. Uytborck, Belgium. 3. Frans Dupont, Belgium.
4. E. Helberg, Norway. 5. A. F. Enstrom, Sweden.
6. Col. R. E. B. Crompton, England, honorary president I. E. C.
7. G. Semenza, Italy, president I. E. C.
8. Dr. C. O. Mailloux, United States, honorary president I. E. C.
9. P. Girault, France. 13. M. Genissieu, France.
10. Sir Richard Glazebrook, Great Britain, chairman British National Committee, honorary secretary I. E. C.
11. C. le Maistre, England, general secretary I. E. C. 12. Prof. Dr. R. Rudenberg, Germany.
14. Prof. Dr. M. Kloss, Germany. 15. Prof. L. Lombardi, Italy. 16. W. H. Tromp, Holland.
17. Prof. C. Feldmann, Holland. 18. Prof. M. Chatelain, Russia.
19. Prof. V. List, Czechoslovakia.

Foreign Visitors Now En Tour

I. E. C. Delegates See Philadelphia, Washington, Pittsburgh, Chicago, Detroit and Niagara—Are Now in Canada—Thence to Boston and Schenectady

LEAVING New York at noon on Friday, April 23, in a special train of eight Pullman cars, more than a hundred delegates to the first meeting of the International Electrotechnical Commission to be held in America have started, with members of their families, on a rapid trip to the principal points of electrical interest in the eastern United States and Canada. Every possible arrangement had been made for their comfort and pleasure and for showing them as many things bearing on electrical progress and as many objects of public interest as was possible in the twelve days the trip was to last.

Philadelphia was reached at 1.45 p.m. Here the new Richmond station of the Philadelphia Electric Company was visited and an automobile tour of the parks and boulevards, with stops at historic points, was made. The University of Pennsylvania and the Philadelphia Country Club were visited in the evening. The delegates were the guests of the Philadelphia Electric Company while in the Quaker City, Vice-president W. C. L. Eglin being chairman of the committee having their entertainment in charge.

WELCOMED AT CAPITAL

Boarding their train Friday night, the delegates arrived at Washington at 7 o'clock Saturday morning and remained twenty-four hours. They were met at the Union Station by a committee headed by R. H. Dagleish, chief engineer Capital Traction Company. After breakfast at the Mayflower Hotel and a sight-seeing trip the visitors went to the White House, meeting President Coolidge and being photographed with him. Lunch was served at the Bureau of Standards, where the laboratories were inspected. In the evening there was a dinner at the Mayflower under the auspices of the Washington Society of Engineers. Secretary Hoover, who headed the Washington committee of arrangements, spoke, asserting that at the New York conference more things had been agreed upon by more nations than in any other international conference of which he had knowledge. He said that the meeting had dissolved in an atmosphere of accomplishment and not one of apology, as had been the case with some other conferences. He expressed personal interest in the subject of nomenclature and, saying that the word "standardization" had been "misused, abused and worn out," suggested an effort to find a substitute term. President Semenza also addressed the diners.

Pittsburgh, the next stop, was reached at 3.30 p.m. Sunday. At this city the Duquesne Light Company, the West Penn Power Company, the Carnegie Steel Company, the Carnegie Institute, the Westinghouse Air Brake Company and the Westinghouse Electric & Manufacturing Company were joint hosts, President Samuel Harden Church of Carnegie Institute heading the committee. The reception committee which met the delegates had T. P. Gaylord, acting vice-president Westinghouse Electric & Manufacturing Company, as its chairman.

Through the courtesy of the Carnegie Steel Company, the visitors were taken on Monday morning on a roofed steel barge up the Monongahela River, passing a number of large plants, and to the National Tube Company works in McKeesport, which were inspected. From there they went by motor coaches to the East Pittsburgh plant of the Westinghouse company, where luncheon was served. They were also taken through the parks and boulevards to the Carnegie Art Galleries, where Colonel Church was host at tea. Dinner was served at the Pittsburgh Golf Club, Schenley Park. Commissioner of Public Works Clark welcomed the guests on behalf of the city, and addresses were made by A. W. Thompson, president of the Philadelphia Company; Professor Kloss of Germany, Professor Hoenig of Switzerland, Señor Santa Maria of Chile and L. B. Atkinson of Great Britain.

Chicago was reached Tuesday morning. Here the local committee was headed by Vice-president Louis A. Ferguson of the Commonwealth Edison Company, that company playing the rôle of host. Breakfast was had on the train, and soon after its arrival at the Union Station a motor-coach tour along the lake front and through the business section got into motion. When luncheon was served at the South Shore Country Club Dr. Max Mason, president University of Chicago, made an address of welcome, Professor Feldmann of Holland responding. In the afternoon there was a tour of the park and boulevard system of the city. Dinner took place at the Edgewater Beach Hotel, and guests were then taken to the Olympic Theater, afterward boarding their train for Detroit.

In Detroit, reached early Wednesday morning, the Detroit Edison Company and the Ford Motor Company were joint hosts, Alex Dow serving as committee chairman. The River Rouge plant of the Ford Motor Company and the Trenton Channel power plant of the Detroit Edison Company were inspected, lunch being served at the building last named. An automobile tour terminated across the river in Windsor, Ontario, where the delegates found the train ready to start for Niagara Falls.

NIAGARA FALLS REACHED

The Hydro-Electric Power Commission of Ontario and the Niagara Falls Power Company were joint hosts at Niagara, George S. Anderson of the latter company acting as chairman of committee. Thursday and most of Friday were, according to schedule, to be spent at Niagara. Then the Canadian National Committee was to take charge of the visitors for their trip to Toronto, Ottawa and Montreal, general arrangements being in the hands of John Murphy of the Dominion Department of Railways and Canals. Friday evening, Saturday and Sunday were to be devoted to Canada. Boston will be reached on Monday morning, Schenectady on Tuesday and New York Wednesday afternoon, completing the tour.

For World-Wide Standards

Basis of Association Laid at Conference in New York and Draft of Constitution Drawn

THE basis of a general international organization for industrial standardization was laid at the third international conference on standardization, which met in New York City last week concurrently with the International Electrotechnical Commission, by unanimous agreement upon the draft of a constitution for the new international body. At this conference the national standardizing bodies in eighteen countries were officially represented, Hungary and Australia alone being without delegates. It was presided over by C. E. Skinner, chairman American Engineering Standards Committee.

The proposed constitution of the new organization, which is to be called the International Standards Association, states the aims and objects of the association as follows:

"To lay the groundwork for international agreement upon standards by providing simple systematic means of interchanging information on the standardization work and activities in the different countries; to develop general guiding principles for the assistance of the national standardizing bodies; to promote uniformity among the standards of the various national bodies. It is the intention of the International Standards Association that its work shall include the approval of international standards, and the administrative machinery herein set up is so designed that it may be readily extended or modified to include the approval of such international standards when sufficient experience has been acquired."

"PLENARY ASSEMBLY" SET UP

The members of the International Standards Association are to be the central national standardizing bodies existing in the different countries, one for each country accepting this constitution. The chief executive body is to be the "plenary assembly," composed of delegates of all the national bodies, with the final authority resting with the latter. Provision is also made for an administrative council, with control of finances and administrative matters and with advisory powers on important questions.

The conference recommended that the seat of the new organization be in London, final decision to be made by the first plenary assembly. Work on technical questions will be in the hands of technical committees, with official representation from each country interested. The financial support is to be divided into three parts—25 per cent of the total budget as a fixed sum to be divided equally among the national bodies, 50 per cent of the total budget based on the total annual foreign trade of each country, 25 per cent of the total

budget based on the population of each country.

The conference appointed a committee of seven to submit formally the proposed constitution to the twenty national standardizing bodies and to arrange for a plenary conference for final ratification and organization. The countries represented on the committee are Belgium, Czechoslovakia, Germany, Great Britain, Sweden, Switzerland and the United States. During the sessions informal negotiations were opened with the International Electrotechnical Commission in regard to a unified organization of the two associations.

Joint Committee for Power Companies' Bid

Four Members Support It, Against One for American Cyanamide Bid and One Opposed to All the Offers—Eventual Acceptance of Report Predicted

By PAUL WOOTON
Washington Correspondent *Electrical World*

THE joint congressional committee which has been considering the Muscle Shoals problem since March 15, in co-operation with an interdepartmental committee of experts, recommended on April 26 the acceptance of offers made by the Muscle Shoals Fertilizer Company and the Muscle Shoals Power Distributing Company. These two companies were formed by thirteen Southern power companies, headed by the Alabama Power Company, for the purpose of undertaking the functions indicated by their names. Originally there were nine bids submitted for the government's properties on the Tennessee River. Of this number, however, only three were considered, and finally the question narrowed to a selection of either the bid of the power companies or that of the American Cyanamide Company. Four of the six members of the committee supported the power companies' bid. Senator Heflin supported the offer of the American Cyanamide Company and Representative James of Michigan opposed the acceptance of any of the offers submitted.

Whether or not the offer of the Southern power companies for Muscle Shoals is accepted at this session of Congress, the prevailing opinion on Capitol Hill seems to be that this offer eventually will be approved. It provides for a fertilizer program which is regarded by many as being better than that proposed by Henry Ford. It provides that all the power not used in fertilizer production is to pass into public utility use. This part of the program is strongly supported by labor, as it is expected to provide for the maximum amount of new employment. The monetary return to the government $181,000,000 over the fifty years, is more than twice the return under any other offer.

TERMS OF THE BID

Senator Deneen of Illinois, chairman of the joint committee, made public the following summary of the bid from the associated power companies:

A. For Dam No. 2 alone.....	$88,300,000
B. For Dams Nos. 2 and 3....	109,348,000
C. For Dam No. 2 alone, but with primary horsepower increased by headwater storage developed within ten years	136,300,000
D. For Dams Nos. 2 and 3 with primary horsepower increased by headwater storage developed within ten years	181,348,000

The Senator also gave out the following statement prepared by the committee's technical advisers:

The bid recommended by the majority members of the committee is the bid submitted by the Muscle Shoals Fertilizer Company and the Muscle Shoals Power Distributing Company. The committee reaches its acceptance of the bid on the following basis:

National Defense.—National defense is adequately served by this offer. The present plant or its equivalent in respect to capacity is to be maintained (until released by Congress) in its present state of readiness for the manufacture of explosives; the premises and personnel may be taken over by the United States whenever necessary in the interest of national defense, and a maximum amount of power is rendered available from the interconnected system for war industries.

Benefits to Agriculture.—Agriculture is served by a definite program of fertilizer production up to and beyond the present capacity of the plant. Operation is for the production of nitrates primarily, with rigid limitations on profit and strong guarantees of performance.

(a) The fertilizer company agrees to produce annually 40,000 tons of nitrogen in the form of concentrated fertilizer, by means of synthetic ammonia and phosphoric-acid plants, as follows: Within three years, 10,000 tons annually of fixed nitrogen; within the succeeding three years, an additional 10,000 tons annually of nitrogen —total, 20,000 tons annually; thereafter, in succession, two additional units of 10,000 tons each annually, dependent on the sale for two consecutive years of such amount stipulated up to that time. Production beyond 40,000 tons annually is provided for but not guaranteed.

(b) A capital of $20,000,000 is provided by the bidder for this program of fertilizer production.

(c) The company agrees to limit its profits on fertilizer to 8 per cent on cost.

(d) A farmer board of five members appointed by the Secretary of Agriculture shall regulate the sale and territorial distribution of fertilizer products and provide for an audit of the cost of fertilizer. This farmer board has free access to the books and records of the company.

(e) Fertilizer is to be offered for sale to farmers, co-operative purchasing organizations of farmers, associations of farmers and to others as the farmer board may direct.

(f) The fertilizer company has preferred use of all power generated at Muscle Shoals for the production of nitrogen and other fertilizer ingredients.

(g) The Muscle Shoals Power Distributing Company guarantees the fertilizer performance of the Muscle Shoals Fertilizer Company and agrees to surrender its power lease in event of forfeit in the fertilizer contract.

Monetary Return to the United States.—In addition to insuring an economic program of nitrate and fertilizer production, the bid provides the largest monetary return to the United States of any of the bids considered—first, with the properties as they now stand without further expenditure by the United States; second, they provide larger financial returns for increased power at these properties due to upstream developments, regardless of whether these latter are made by the United States or by other interests.

The bid recommended by the committee from the Muscle Shoals Fertilizer Company and Muscle Shoals Power Distributing Company will return to the United States in the fifty-year lease period the following amounts:

(a) For Dam No. 2 alone, but with primary horsepower increased by headwater storage developed by private interests within ten years $136,300,000

(b) For Dams Nos. 2 and 3 with primary horsepower increased by headwater storage developed by private interests within ten years $181,348,000

The bid of the Air Nitrates Corporation, the other principal competing bid for the Muscle Shoals properties, would return to the United States in the leased period $85,931,000, but this would involve the construction by the United States of Dam No. 3. The maximum offered by this bidder, involving the building by the United States of Cove Creek Dam in addition to Dam No. 3, is $95,739,000.

Freedom from Requirement of Additional Expenditures by the United States.—The bid recommended has an advantage in that it does not require additional appropriations by the United States involving the further expenditure of large sums of money on the Muscle Shoals property. The bid provides conditions covering returns to the United States in event Dam No. 3 is at any time constructed by the government, but the government is not committed to the construction of this dam or any other dams as a condition of the lease.

SIX REASONS FOR REPORT

Senator Deneen also issued the following personal statement:

"The majority of the committee favor acceptance of the proposal submitted by this company:

"First—Because its proposal adequately met the consideration of national defense.

"Second—Because its proposal appeared to us to be the most beneficial to agriculture. A definite program for 40,000 tons of fixed nitrogen is provided; production of 20,000 tons of fixed nitrogen within six years is guaranteed and production of additional nitrogen as assured demand comes from the farmers, whereas in the proposal of the nitrate company (the American Cyanamide Company) production of nitrogen above 20,000 tons was contingent on upper river developments at large expense.

"Third—Our analysis of the financial aspects of the proposal with respect to the monetary returns to the government indicates that the ultimate total return to the United Sales would be approximately twice the amount which the government would receive from the nitrate company.

"Fourth—The Muscle Shoals Fertilizer Company's contract is guaranteed by the power distributing company, and in event of default for six months by the fertilizer company in the production of fertilizer the government has the right to terminate the power lease. There is thus provided means for the government to take back the electric power if fertilizer is not provided. No other proposal presented such adequate guarantees and such complete protection to the United States.

"Fifth—The proposal which we have recommended does not require appreciable expenditures by the United States, whereas the nitrate company's proposal requires at the outset an expenditure by the United States of an amount estimated at $32,500,000 and makes production of nitrate above 20,000 tons contingent upon additional expenditures by the United States which might increase the total to $75,000,000.

"Sixth—An equitable distribution of surplus power under the proposal of the Muscle Shoals Power Distributing Company is assured the Southeastern States under strict supervision and regulation of federal and state authority."

A minority report was submitted by Representative James of Michigan.

It makes a bitter attack on the Alabama Power Company and its president, Thomas W. Martin, saying that in dealings with the United States they have "played the part of a gang of cheap tricksters." The associated companies' bid is, according to Mr. James, dishonest in that the return offered to the government is purposely put so high as to make nitrate manufacture impossible and thus insure the entire output at the dam for power. The whole history of the relations between the government and the Alabama Power Company during and since the war is reviewed by Mr. James in a way which shows, according to him, that the company has consistently acted selfishly and in bad faith. "In the last analysis," he concludes, "the majority report is an invitation to the members of the House to adjourn and go home and tell their constituents that thirteen power companies, peddling power in the South, have decided that Muscle Shoals is neither a national defense nor a fertilizer proposition, but a power proposition."

Boulder Dam Bill Is Reported—Senator Ashurst Denounces It

A favorable report on the Swing-Johnson bill has been made to the Senate by the committee on irrigation and reclamation. The report was made over the protest of Senator Ashurst, who has filed an extended minority report. He contends that the bill proposes to raise revenue and for that reason must originate in the House. The bill in the form in which it is now pending provides for a dam at Boulder or Black Canyon on the lower Colorado River, for the construction of an All-American canal for the delivery of water to the Imperial Valley and for a power plant.

Secretary Mellon's suggestions for the financing of the project are embodied in the bill. A Boulder Canyon fund is set up in the Treasury. The Secretary of the Treasury is authorized to advance to the fund up to $125,000,000, from which interest payments are to be deducted. The interest during the construction period will amount to nearly $21,000,000. The Secretary of the Interior is authorized to make contracts for the sale of power at the switchboard and for water for irrigation and domestic uses. The dam and works are to remain the property of the government even after they are paid for by the beneficiaries. Contracts for power are limited to fifty years. Renewals are to be made as provided in the water-power act. Conflicting applications also are to be handled along the lines of this act. Small agencies are to be permitted to share in the use of transmission lines. The Secretary, in his discretion, may lease the privilege of using the water discharged at the dam.

Approval of the Colorado River compact is provided without waiting for its ratification by Arizona. Another section contemplates the making of a subsidiary compact by California, Arizona and Nevada. An authorization for investigations of the problems of the upper Colorado is also provided.

Senator Ashurst for the minority declares the purpose of the bill is to coerce Arizona and predicts its failure. He further declares that a high dam at Boulder will prevent the development of the maximum resources of the stream and declares it to be "abysmal folly" to use 200,000 firm horsepower in the eternal task of raising water 1,730 ft. for use in southern California, when adequate supplies can be obtained at no greater cost by diverting the water at Bridge Canyon. That dam, with another at Glen Canyon, he claims, would allow the maximum use of the waters of the river.

Secretary Work Urges Speed on Colorado Settlement

Speaking before the Los Angeles Chamber of Commerce at a luncheon on April 26, Secretary of the Interior Work urged speedy ratification of the pending Colorado River compact. "The necessity for an early settlement of the respective rights of the different states and two nations in this river and in the carrying out of the proposed development on the lower portion of the stream is vital," Mr. Work declared. "The potential benefits to be derived from this development are of great national interest and importance. It is therefore of the greatest importance that agreed-upon facts in connection with this Colorado River development be set properly before Congress as a national undertaking so that suspicion may be avoided that its purpose is for personal promotion or local development only.

"It is my belief that as soon as the Boulder Dam legislation has been approved by Congress the applications for private power development should have immediate consideration. There does not seem to be any danger that the power market will be oversupplied. On the contrary, cheap power will help to open up new mines, promote the building of new railroads and multiply industries. If an organized corporation, competent and willing to develop this project in its several ramifications, will come forward and submit a contract to build these structures and place their operation under such control of the government as will protect the many and diversified interests involved, the Secretary of the Interior will recommend to Congress that such proposition be sympathetically entertained. The Colorado River compact is being resisted by a state that could profit by this comprehensive development. Maneuvering for individual or corporate advantage is being resorted to by those speculating in hopes, but it is confusing the main issue."

Progress of Arc Welding

Meeting at the Engineering Societies Building, New York, April 21-23, the American Welding Society carried through a working and technical program diversified by the annual dinner and by a popular demonstration of the wonders of liquid oxygen.

The main feature of the meeting of the electric arc welding committee on Wednesday afternoon was a discussion of the results of tests made to determine the effect of such factors as current, size of electrodes, design of joints positions of welding, etc., as presented by the sub-committee on the fundamentals of arc welding. This was preceded by a report of the sub-committee on non-ferrous metals.

There was much discussion of the reliability of welding, and it was generally agreed that a strength of 36,000 lb. to 40,000 lb. could be absolutely depended upon with properly trained welders.

The American Bureau of Welding held its annual meeting on Friday morning, with five-minute discussions by experts on suggested researches and a review of progress by sub-committee chairmen with plans for new work. Among those who spoke were Prof. C. A. Adams of Harvard, H. M. Hobart, S. W. Miller, H. L. Whittemore and J. H. Edwards. The new president of the American Welding Society will be F. M. Farmer, chief engineer Electrical Testing Laboratories, New York.

Electrochemists Have Successful Chicago Meeting

With an excellent attendance—more than two hundred—the forty-fifth meeting of the American Electrochemical Society, held at the Chicago Beach Hotel April 22-24, was an entire success, much interest being manifested in the papers and the round-table discussions. The outstanding event was the symposium on chlorine, the papers by Amos A. Fries and H. L. Gilchrist being especially noteworthy.

F. M. Becket, the retiring president, took occasion in his address to dwell on the importance of estimating costs before going too far with new processes. Enthusiastic investigators, he maintained, were prone to overlook this practical aspect, and the waste effort put forth along uneconomical lines caused, in his own knowledge, a loss running into the millions.

The new president will be William Blum of the Division of Chemistry, Bureau of Standards. The next meeting will be held at Washington on Oct. 7 to 9.

Insull Interests Negotiating for Bradford (Vt.) Utility

Negotiations are in progress for the sale of the Bradford (Vt.) Electric Light Company to the New England Public Service Company, and if the transaction goes through as planned, an important property serving many communities in the upper Connecticut Valley and in the western White Mountain area will be added to the Insull holdings in northern New England. For the past few years the Bradford company has been under the management of John A. Prouty, who is also manager of the Newport (Vt.) Electric Light & Power Company, and about one million dollars has been invested in its development. Extensive transmission-line construction has lately been carried out to distribute hydro-electric power from the International Paper Company's plant at Wilder, Vt., to the Littleton (N. H.) district with interconnections to various local utilities in the White Mountain region. The Insulls already operate an important interconnection between the Twin State Gas & Electric Company plants in Gorham, N. H., and St. Johnsbury, Vt.

Purchases and Mergers

Barstow, Doherty, Fitkin and Foshay Interests Figure in Recent Changes of Control

THE General Gas & Electric Corporation has acquired control of the Blue Ridge Power Company of Hendersonville, N. C., the Manufacturers' Power Company of Spartanburg, S. C., and their subsidiaries. These companies supply electric light and power to a number of cities in the two Carolinas, of which those just named are the most important. In announcing the transaction W. S. Barstow, president of the General Gas & Electric Corporation, said that John A. Law will continue as president of the Blue Ridge Company. The General Gas & Electric already controls the South Carolina Gas & Electric Company, which also supplies Spartanburg and smaller cities in that state.

The Cities Service Company, which for some time has supervised operations of the Georgia Light, Power & Railways Company, has bought a very substantial interest in the property, as was forecast by the recent election of Henry L. Doherty representatives to the Georgia Light board. The Georgia Light is a holding company controlling the Macon Railway & Light Company, Macon Gas Company, Georgia Public Service Corporation of Macon, Central Georgia Power Company and Central Georgia Transmission Company. The property is adjacent to properties controlled by the Southeastern Power & Light Company, and there is an unconfirmed report that the last-named company may take over the Georgia group.

The Fitkin Utilities of New York has announced the acquisition of the Georgia-Florida Power Company and its subsidiaries, the Seminole Power Company and Bainbridge Power Company. This group is located in southwestern Georgia, in the vicinity of Bainbridge, and includes the hydro-electric power plant and transmission lines serving Bainbridge, Donaldson, Brinson, Colquitt, Climax and other towns. Eventually these properties will be tied in with the system of the Fitkin holdings in Georgia and Florida.

The Utilities Power & Light Corporation of Chicago has just announced the acquisition of properties in Minnesota, Iowa, North Dakota, South Dakota, Nebraska and Oklahoma through the purchase of the Tri-State Utilities Company and the Minnesota Electric Distributing Company from the W. B. Foshay interests of Minneapolis. The newly acquired properties are to be operated in conjunction with the Interstate Power Company, a subsidiary of Utilities Power. The W. B. Foshay Company last week completed purchase of the properties of the Midland Power Company in northwestern Minnesota, which supply electrical energy to the towns of Brooks, Mentor, McIntosh and Fosston. The Midland plants are being interconnected with the Minnesota Electric Light & Power Company's properties, which are also controlled by the Foshay interests.

The Northern States Power Company has offered the city of Sioux Falls, S. D., $180,000 for its municipal street-lighting system.

The Hamden (N. Y.) Electric Light Company, exercising a franchise in Delaware County, has asked permission of the Public Service Commission to transfer its plant to the New York State Gas & Electric Corporation, which occupies territory entirely surrounding the town of Hamden.

The electric light and power systems at Lovell and Newcastle, Wyo., have recently been purchased by the Midwestern Power Company. Lovell is in the northern end of the Big Horn basin and is about 37 miles from Greybull, where the Midwestern Power Company has owned the electric system for some months. Newcastle is the county seat of Weston County and is about 45 miles from Edgemont, S. D., where the Midwestern Power Company has a generating plant.

United Securities, Ltd., of Montreal announces in its annual report the consummation in February of the sale of its holdings of common shares in the Quebec - New England Hydro - Electric Corporation to the Montreal Light, Heat & Power Consolidated. Thus the Montreal Light, Heat & Power finally acquires the entire business and undertakings of the Quebec-New England Corporation in accordance with the plan formulated two years ago.

Court Prevents Public Ownership in Porto Rico

Government ownership and development of hydro-electric power in Porto Rico as provided for by an act passed by the last Legislature has been checked, if not killed, by a decision of the United States court granting a permanent injunction against the Commissioner of the Interior and the insular treasurer to restrain them from carrying out the provisions of the law. The court held that the law violated the provisions of the organic act of Porto Rico regarding taxation, that it attempted illegally to delegate legislative powers to the Commissioner of the Interior, that the tax imposed was not for public purposes and that the Legislature illegally sought to deprive the Public Service Commission of powers vested in it by Congress.

Petition for an injunction was brought by the Porto Rico Railway, Light & Power Company as a taxpayer and as holder of a franchise under which it operates hydro-electric and steam plants generating electric power which it distributes in twenty-eight municipalities of the island. The company alleged that the Commissioner of the Interior was about to commence the construction of hydro-electric plants in the territory now served by the company under its franchise and that the resultant competition would irreparably damage its business.

It was shown in the testimony that the complainant had filed an application with the Public Service Commission for a franchise authorizing it to develop the water power of the Rio Blanco or its affluents and that this petition is still pending before the commission; also that the complainant must soon increase its capacity either by obtaining additional water power or by building new steam plants.

Mountain Men Succeed

Fifth Annual Convention of Electrical League at Salt Lake City a Profitable One

NEARLY two hundred members of the electrical industry, representing its various branches in Salt Lake City and adjacent territory, were in attendance at the fifth annual convention of the Rocky Mountain Electrical Co-operative League, held at the Newhouse Hotel in Salt Lake City last month. This convention proved by far the most successful in the league's history. Vice-president B. E. Rowley welcomed the delegates.

T. T. Burton, City Commissioner of Salt Lake City, spoke on the subject of "Electrical Wiring as It Affects Public Safety," and in the discussion H. M. Ferguson, manager of the Utah Power & Light Company's Salt Lake division; Charles J. Reading, of the city's electrical department; Walter S. Knight, Salt Lake City's fire chief, and F. D. Winegar, city electrical inspector, took part. George R. Randall, president of the league, recommended a more agressive policy and urged that recipients of electrical contractors' licenses should be required to show certain qualifications.

President Randall then spoke on "League Activities—Past and Future." He emphasized the good work accomplished by the Lighting Service Bureau, which is clearly shown by marked increases in kilowatt-hour consumption, and called attention to the fact that of 330 lighting layout jobs planned by the bureau, 245 had been closed.

Edward H. Eardley, manager of the Eardley Electric Company of Salt Lake City, spoke on "The Electrical Contractor's Problems." He said that electrical contractors in the United States spend $160,000,000 per year, 85 per cent of which is bought direct from the manufacturer.

Good Addresses at Banquet

At the evening banquet J. A. Kahn, president of the Capital Electric Company of Salt Lake City, was toastmaster. Speakers were E. L. Bourne, Utah Power & Light Company; Charles J. Reading, of the city electrical department; W. A. Moser, Westinghouse company; J. V. Buckle, Buckle Electric Company; P. M. Parry, Utah Power & Light Company; A. C. Cornell, manager of the Graybar Electric Company's Denver branch and president of the Electrical League of Colorado, who presented an interesting paper on "The Jobber's Viewpoint," and S. W. Bishop, executive manager of the Electrical League of Colorado, whose subject was "Outlets for Outlets."

The convenience outlet program, Mr. Bishop said, after all is said and done, is the big medium through which the benefits to the electrical industry can be increased. He complimented the electrical people of the Intermountain territory served by the Utah Power & Light Company in regard to the world's record which this section enjoys in annual kilowatt-hour consumption per capita. In regard to methods of operation of leagues, and specific activities, Mr. Bishop suggested the advisability

of not giving too much pressure to one particular activity, but getting the general idea over to the public by plenty of publicity. He favored adequate electric wiring standards as reflected by electrical inspection codes, encouraging the giving of the best for the money so that the greatest service and economy will be had by the customer ten years from now; uniform electrical ordinances, the national code considered as a minimum for operation in any city, and a maximum of service compared with cost of wiring. On the subject of merchandising by the central-station company Mr. Bishop declared that in every city throughout the country where the league work is a success it will be found that the central station is aggressively merchandising.

Briefer News

Topeka (Kan.) Rates Cut.—Voluntary rate reductions to large power consumers have been announced by the Topeka (Kan.) Edison Company, officials estimating that the saving to Topeka customers will approximate $15,000 annually. One reduction affects the general lighting and power rate, while another will result in a lower charge to wholesale users of power. The reductions follow the completion of the station at Tecumseh, and further reductions may follow as new business develops.

Potomac Electric Power Company to Enlarge Bennings Plant.—The Potomac Electric Power Company, Washington, is to enlarge its 125,000-kw. Bennings power station by the installation of a 30,000-kw. turbo-generator designed for stage extraction feed-water heating, operating at a steam pressure of 350 lb. and at 700 deg. F. total temperature, as well as four boilers, each having a capacity of 1,400 hp., with interdeck superheaters, water-cooled furnace walls and air preheaters. Stone & Webster, Boston, are the designing and constructing engineers.

Oakland, Cal., to Investigate Power Possibilities.—In order to determine whether there are any feasible power projects on the upper reaches of the Mokelumne River which might be developed in connection with the domestic water-supply system now being built by the city of Oakland, Cal., Lester S. Ready, chief engineer of the California Railroad Commission, has been retained by the Oakland Chamber of Commerce to make an investigation. The Mokelumne River rises in the Sierra Nevada Mountains of north-central California, flowing into the San Joaquin River near its mouth.

Another New Brunswick Hydro-Electric Project.—A bill has been introduced in the Legislature of the Province of New Brunswick to incorporate the River St. John Electric Development Company, Ltd., with an authorized capitalization of $100,000, to generate electrical energy on the St. John River about 16 miles below Grand Falls by building there a 30-ft. dam. A transmission line to Fredericton, 60 miles up the river, is contemplated. A committee is investigating the possible interference of such a plant with the Grand Falls development to which the province is committed.

Philadelphia Electric Club to Exhibit Electrical Home at Exposition.—At the Sesquicentennial Exposition to be held at Philadelphia from June 1 to Dec. 1 a complete electrical home will be exhibited under the auspices of the Philadelphia Electric Club. Ground for this model residence was broken by President Birdsell of the club on April 22, following a luncheon meeting, which was addressed briefly by Walter H. Johnson, president of the Philadelphia Electric Company; J. McClatchy, builder of the house; O. H. Caldwell, editor of *Electrical Merchandising*, and S. G. Crosby, the originator of the idea.

Commonwealth Edison's Big Units.—The accompanying photograph shows assembly of the casing of the low-pressure element of the 77,000-kw. cross-compound steam turbine which is soon to be installed in the Crawford Avenue station of the Commonwealth Edison Company of Chicago. The turbine is, the manufacturer says, larger

than any now in commercial operation. The part shown is 16 ft. 4½ in. in diameter and 9 ft. 10⅛ in. in depth. It weighs 101,648 lb. As already announced, the Commonwealth Edison Company has ordered, also from the General Electric Company, a still larger turbo-generator to follow this one. The unit just ordered will be rated at 90,000 kw. and will consist of two sections—a high-pressure element of 35,000 kw. capacity running at 1,800 r.p.m. and a low-pressure element of 55,000-kw. capacity running at 12,000 r.p.m.,

Electric Pumping for Texas Rice Fields.—Electric power for operating irrigation pumping plants is to be supplied to rice-growing districts by the Texas Central Power Company, according to E. B. Neiswanger, general manager. More than 30,000 acres of rice are contained in irrigated districts embraced in the power transmission system of the company near El Campo, Eagle Lake, Louise and Bay City. An initial requirement of 2,700 hp., with 60 miles of transmission lines, will be necessary, and the service offers large possibilities of expansion. Although service in the rice fields is new, the Texas Central Power Company has for several years been steadily widening its pumping service in the lower Rio Grande Valley and about three months ago it erected a distributing station at Crystal City, from which all power which may be needed in pumping from wells and the Nueces River throughout the "winter garden" area can be supplied.

Talking Across the Atlantic. — A glimpse of the coming day when trans-atlantic telephone talks will be commonplace was afforded on a recent Sunday when David Sarnoff, vice-president of the Radio Corporation of America, talked from his home in Mount Vernon, N. Y., with Owen D. Young, chairman General Electric Company board, at the hotel where he was staying in London. After a few moments' conversation Gerard Swope, president General Electric Company, was called up at his residence in Ossining, N. Y., and he conversed in his turn with Mr. Young. Excellent transmission was reported.

Winnipeg Agreement Still Blocked.—No action has yet been taken in Winnipeg, Manitoba, on the proposal made months ago that the municipal Hydro-Electric System purchase 50,000 hp. from the Manitoba Power Company at $18.50 per horsepower, the latter to withdraw from the light and power field in the city and the Hydro, in turn, to cease to operate in the suburbs of Winnipeg. In the meantime the Hydro manager declares that unless some arrangement is arrived at or the city's reserve power site at Slave Falls immediately developed, the city will be forced to buy power from the company at the latter's own price.

Manufacturers in Center New York Can Continue to Generate Power from Erie Canal.—A bill authorizing the abandonment of a portion of the old Erie Canal in the counties of Saratoga and Albany was defeated in the New York Senate before its adjournment last week by a vote of 28 to 17. Its opponents declared the bill would deprive manufacturing interests in Cohoes, Watervliet and Green Island of the right to the use of the natural flow of water they had enjoyed for more than a century. Many of these manufacturers now generate hydro-electric power for their mills and would, it was declared, be obliged to purchase energy were the bill passed.

Contract for Lewiston (Idaho) Dam Signed.—A contract for the construction of a power dam, forebay dike and power house on the Snake River at Lewiston, Idaho, has been awarded to the Winston Brothers of Minneapolis. The cost of construction will exceed $2,000,000. The power project is a part of a joint timber development plan in which the Weyerhauser interests and Northern Pacific and Union Pacific railroads are identified. The entire project will cost more than $13,000,000. The contractors are expected to start work this month and to have the dam completed in a year. The dike will be 7,000 ft. in length. The railroads are building a 41-mile branch line and the Weyerhauser company is building a

lumber mill adjoining the power site. The timber company is under contract to furnish 200,000,000 ft. of timber annually to the railroads when the project is completed.

Wisconsin Utilities Association Not to Meet This Year.—It was recently decided to forego the usual annual convention of the Wisconsin Utilities Association this year and to substitute therefor a convention by means of the association bulletin. Election of officers accordingly took place by mail, and the results, together with reports of officers and committees, will be printed in the bulletin of the association.

Stone & Webster Managers to Convene in Virginia.—A conference of from 250 to 300 managers and executives of properties run by Stone & Webster, Inc., Boston, will be held from May 10 to 13 inclusive at Norfolk, Va., adjourning to meet in Richmond May 14 and 15, according to an announcement by W. E. Wood, vice-president Virginia Electric & Power Company. This will be the first time the conference has met outside of Boston, and the program will cover a wide range of public utility topics, inspection of plants and entertainment features. Speakers of national importance in the industry have been invited to address the gathering.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, Jan. 2, page 80.]

Missouri Association of Public Utilities —Springfield, Mo., May 2-4. F. D. Beardslee, 315 North 12th St., St. Louis.

American Institute of Electrical Engineers — Regional meetings: Madison, Wis., May 6-7, and Niagara Falls, N. Y., May 26-28. F. L. Hutchinson, 33 West 39th St., New York.

National Fire Protection Association—Atlantic City, N. J., May 10-13. F. H. Wentworth, 40 Central St., Boston.

Electrical Manufacturers' Club — Hot Springs, Va., May 12-15. W. F. Field, Safety Cable Co., New York.

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

National Electrical Credit Association —New York, May 20-21. F. P. Vose, 1008 Marquette Bldg., Chicago.

Electric Power Club—The Homestead, Hot Springs, Va., May 24-27. S. N. Clarkson, Keith Bldg., Cleveland.

American Association of Engineers—Philadelphia, June 1-6. M. E. McIver, 63 East Adams St., Chicago.

Electrical Supply Jobbers' Association —The Homestead, Hot Springs, Va., June 2-4. F. Overbagh, 411 South Clinton St., Chicago.

Associated Manufacturers of Electrical Supplies — The Homestead, Hot Springs, Va., June 7-11. F. Nicholas, 30 East 42d St., New York.

North Central Division, N.E.L.A.—St. Paul Hotel, St. Paul, June 8-10. J. W. Lapham, 351 Loeb Arcade, Minneapolis.

Pacific Coast Division, N.E.L.A.—Biltmore Hotel, Los Angeles, June 8-11. S. H. Taylor, 447 Sutter St., San Francisco.

Northwest Division, N.E.L.A. — Spokane, Wash., June 14-17. L. A. Lewis, Washington Water Power Co., Spokane.

Men of the Industry

L. W. Gaskell has been appointed director of public relations of the Michigan Gas & Electric Company.

M. S. Blair has been appointed general superintendent of construction and operation of distribution systems in all Wabash Valley Electric Company districts.

General James G. Harbord, president of the Radio Corporation of America, returned to New York April 27 aboard the French liner *Paris* after a sojourn in London, where he attended the opening of the new photoradiogram service of the corporation.

E. M. Tubbs has been appointed superintendent of electric distribution of the Consumers Power Company at Kalamazoo, Mich., to succeed A. E. Kriegsman, who is now connected with the Commonwealth Power Corporation in New York.

W. H. Lemons of Rockford, Ill., has been elected secretary of the Illinois Power Company, Springfield, to succeed C. M. Lewis, who resigned because of ill health. Mr. Lemons was auditor of the company from 1907 to 1909 and has since been secretary of the Rockford City Traction Company.

J. C. Donald, district manager of the Keyport territory of the Jersey Central Power & Light Company, has been transferred to the West Florida Power Company. Mr. Donald will be succeeded at Keyport by **A. D. Schultz**, who was formerly with the Municipal Service Company at Coatesville, Pa.

A. E. Kriegsman, electrical superintendent of the Kalamazoo district of the Consumers Power Company for the past five years, has affiliated himself with the Commonwealth Power Corporation in New York. Mr. Kriegsman was formerly connected with the engineering department of the Consumers Power Company at Jackson.

Clarence L. Law, assistant to the vice-president in charge of commercial relations of the New York Edison Company, has been made an Officier de l'Instruction Publique by the French government. This decoration was bestowed on Mr. Law as a fitting recognition of his work in behalf of the exposition of household appliances and labor-saving devices held in the Grand Palais in Paris during the month of February.

Dr. H. R. Wright has been appointed managing director of Siemens Brothers & Company, Ltd., of Woolwich, England, to succeed the late Francis Hird. Dr. Wright, who is 49 years of age, commenced his scientific and engineering training at the Regent Street Polytechnic, London, and continued at the Technical High Schools at Munich and Karlsruhe, Germany, and at the University of Munich. Before returning to England he acquired practical knowledge of Continental dynamo design at Vienna under a well-known Austrian designer, the late Professor Pichelmayer, and then obtained an appointment with Siemens Brothers & Company, Ltd., at Stafford. During the 24 years of his service with the Siemens undertakings he has been successively concerned with the activities of nearly every one of the departments, from designing large generator units to the introduction of mass production of small dry cells. In later years he has been drawn more and more to the administrative side, and last year he was appointed general manager.

W. F. Severance has been appointed superintendent of distribution of the Consumers Power Company at Battle Creek to succeed T. C. Dee, now in the engineering department at Jackson.

J. O. Davis, Jr., of Franklin, Tenn., has resigned as secretary of the Williamson County Chamber of Commerce to become publicity director for the Southern Cities Power Company, Chattanooga.

W. C. McWhinney has been made assistant general commercial manager of the Southern California Edison Company, according to an announcement made by W. L. Frost, general commercial manager. **A. W. Childs**, who has been general sales manager, has been appointed manager of new business, and **R. I. Carruthers**, who has been assistant general sales manager, has been made manager of the merchandising department.

Ira F. Wortendyke, who has been occupying the post of vice-president and general manager of the New Gas Light Company of Janesville for a number of years, has been appointed district manager of the Wisconsin Power & Light Company's newly combined electric and gas properties in Janesville. Under this new plan, which is the result of the recent purchase of the New Gas Light Company by the Wisconsin Power & Light Company, offices of the two companies will be consolidated.

A. L. Thurston, who has been connected with the Beloit Water, Gas & Electric Company for the past nine years in various capacities, has been named local manager of the Wisconsin Power & Light Company's properties at Beloit. Mr. Thurston will work under the leadership of T. F. Keefe, who is now division manager of the company with headquarters in Beloit. Mr. Keefe was made manager of the Beloit properties when they were purchased last year by the Insull interests.

Major Dewitt C. Jones, Corps of Engineers, has been named by the Secretary of War as the representative of the United States on the Niagara Control Board, created by agreement between the government of the United States and Canada. The board has been organized for the purpose of obtaining closer co-operation between the two governments in the matter of controlling the amount of water diverted from Niagara River for the generation of hydro-electric power. Major Jones recently succeeded Major Paul S. Reinecke as district engineer at Buffalo, N. Y.

Herbert A. Wagner, president of the Consolidated Gas, Electric Light & Power Company, Baltimore, was elected a member of the board of directors of

the Baltimore Association of Commerce at the annual meeting held on April 22.

Vern E. Alden, for the past seven or eight years assistant to the general superintendent of the Consolidated Gas, Electric Light & Power Company, Baltimore, has joined the mechanical engineering staff of Stone & Webster, Inc. Mr. Alden formerly engaged in electrical design work with the Westinghouse Electric & Manufacturing Company. He assumes the duties of his new office May 1.

H. F. Darby, Jr., for more than 20 years connected with the Cutter Electrical & Manufacturing Company, Philadelphia, and for the past six years sales manager of that organization, has resigned to organize a sales service for electrical and power machinery manufacturers. Mr. Darby states that he is planning to visit manufacturing plants throughout the country and expects to establish headquarters in Philadelphia about June 1.

Obituary

Albert F. Walker, for many years sales agent of the American Steel & Wire Company, with headquarters at Boston, died at Winthrop, Mass., April 22. He was born at Worcester, Mass., 54 years ago and had been with the company since early manhood.

Lex J. Kirkpatrick, vice-president and general counsel of the Northern Indiana Power Company, Kokomo, died March 21. Mr. Kirkpatrick was a prominent figure in utility development in the State of Indiana.

Frederick G. Cartwright, prominent consulting electrical engineer, died at San Francisco, April 10, at the age of 60. Mr. Cartwright had been identified with many of the earlier power-plant construction jobs on the Pacific Coast since the 90's and held official positions with a number of the predecessor companies of the present utilities. At the time of his death he was practicing consulting engineering in San Francisco.

Albert J. Young, Jr., sales manager of the conduit department of the General Electric Company's merchandising section, Bridgeport, Conn., died April 17 at the Fifth Avenue Hospital, New York, following a long illness. Mr. Young in 1904, when he was seventeen years old, was employed by the Sprague Electric Company, New York, formerly a subsidiary of the General Electric Company. He subsequently became salesman for electrical apparatus and was made manager of the New York district sales. In 1918 Mr. Young was appointed manager of the conduit department of the General Electric Company, four years later removing to Bridgeport with the merchandising department as sales manager of the conduit department. He was well known in the electrical industry and was considered an authority in the conduit and armored-cable field. He was chairman of the armored-cable division of the American Manufacturers of Electrical Supplies and was secretary of the rigid-conduit section of that organization.

Recent Court Decisions

Limitations of Commission's Power.—Holding the granting of a certificate of convenience and necessity to a bus company in competition with an established line to be "unreasonable, arbitrary and confiscatory," the Supreme Court of Illinois took occasion to emphasize the point that the public utilities act does not vest the commission with arbitrary powers but requires that its orders shall be "lawful and reasonable." (150 N.E. 668.)*

Reasonable Rates Must Precede Enlarged Equipment.—In a suit brought by the Middlesex Water Company against the New Jersey Board of Public Utility Commissioners to upset a rate fixed by the latter, the United States District Court of New Jersey decreed that before the company could be held culpable for not having laid a larger main an opportunity must be afforded it, through reasonable rates, to earn enough not only to produce a fair return on the value of its property used and useful, but enough more to enable it to obtain capital necessary to install the required main. (10 Fed. (2d) 519.)

Separating Interstate and Intrastate Business.—The United States Supreme Court has upheld the right of the Public Service Commission of Pennsylvania to regulate business of the People's Natural Gas Company at Johnstown, thus affirming the decision of the State Supreme Court. The commission ordered the People's company to continue delivery of gas to a distributing company at Johnstown with which it desired to sever its contract. The company resisted on the ground that the order violated the interstate commerce clause, as part of its gas is piped from West Virginia and mixed with gas obtained from wells in Pennsylvania. The Supreme Court holds that the company's interstate and intrastate business may be separated, inasmuch as it obtains more than sufficient gas within Pennsylvania to carry out its contract at Johnstown, and hence the Public Service Commission's order does not interfere with interstate commerce.

Lineman Working on Transmission Lines Without Wearing Rubber Gloves Held Negligent.—The Supreme Court of New Jersey ordered a rule to show cause made absolute in Brice vs. Atlantic Coast Electric Light Company and Eastern New Jersey Power Company, in which damages had been awarded for the death of a lineman engaged in making repairs after a storm. It was testified that the victim, who was killed by a fire-alarm wire he was holding coming into contact with an electric light wire, did not wear rubber gloves, and the Supreme Court held that for this reason the verdict was against the weight of the evidence on the question of his contributory negligence. It was also held by this court that testimony as to statements made by the lineman concerning the bad conditions under which he was working had been improperly excluded, since it had a bearing on the question of the victim's contributory negligence. (132 At. 253.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Valuation of Water-Power Plant as Affected by Output.—In evaluating the property of the Mackay Light & Power Company, charged with not rendering adequate service to its patrons, the Public Utilities Commission of Idaho dwelt on the difference between the installed capacity of a hydro-electric plant and the amount of the load it is able to carry, saying: "The evidence submitted shows that the value cannot be fixed on the cost of building a plant less the depreciation, but the service which such a plant is capable of rendering after its construction must be taken into consideration. If the Mackay Light & Power Company were capable of delivering to its customers a uniform load of approximately the installed capacity of its plant, it would of necessity be more valuable than if it were only capable of delivering such capacity for a portion of the year. In case the water supply is not sufficient to operate the installed capacity during the entire year, this condition would affect the value of the property, but would in no way affect the cost of reproducing such plant."

Cultivation of Good Public Relations Prescribed as Aid to Increased Business.—The California Railroad Commission in refusing an increase of rates to the Elsinore Gas Works said: "The complaints voiced by the consumers were directed not only at any increase in rate and the usual service troubles regarding which such complaints are customarily made, but related as well to the character of the business dealings of the applicant with its consumers. The attitude of representatives of the Elsinore Gas Works during the hearing was such as to lend color to the charges made by the consumers, and it is quite evident that there has been a marked lack of courtesy and effort to secure satisfactory relations between the utility and its patrons. Under such conditions it would require a far more definite showing than has been made for this commission to give serious consideration to this application. The evidence shows that at the time of the hearing there were many prospective consumers who were not using gas and that certain consumers had ceased the use of gas because of unsatisfactory personal relations with the utility. The plant is well built and in good condition and a sincere effort on the part of its owners to give satisfactory service and courteous treatment to consumers will undoubtedly result in an increase in business and a thoroughly satisfactory return."

Financial and Corporate

Utility Market Improves

Southeastern Power & Light Shares Rally in Anticipation of Action on Muscle Shoals

NO CHARACTERISTIC of the securities market nowadays is so interesting as the pronounced ease in money rates, and during the week under review new evidences of ease appeared. Among these may be mentioned the drop in rate for call money to a 3 per cent level for the first time in more than a year, the decline in bankers' acceptances to the 3¼-3¼ level for the first time since August, 1924, and a new "low" of 4 per cent in time money. To make an adjustment to open-market conditions the Federal Reserve Bank of New York lowered its rediscount rate to 3½ per cent, thus restoring the rate that had prevailed for about a year prior to last January, when a 4 per cent rate was adopted. Restoration of the 3½ per cent level was one of the developments of the week that tended to revive confidence in affairs generally, although, it must be added, the up turn in the stock market was perhaps the more obvious influence in that direction.

Utility stocks improved along with the others, American Water Works & Electric Company's stock on the big board having gained in smart fashion after its long sweep downward. General Electric's strong advance and activity was a feature of the trading. The 4½-point gain in the shares of the Southeastern Power & Light Company was one of the most interesting advances of the week, for back of the rise were two factors—the progress toward a settlement of the Muscle Shoals matter in favor of the Southern power companies of which Southeastern is a leader and the improvement in the money market. Gains were made by American Gas & Electric, Electric Bond & Share (this stock improved its position by more than four points for the week), Electric Investors, Inc., Northern States Power and United Gas Improvement. Losses were recorded by other stocks, but the declines were small.

Philadelphia Electric Issues Annual Report

The annual report of the Philadelphia Electric Company for the fiscal year ended Dec. 31, 1925, reflects a substantial growth in the volume of business done during that period. Operating revenue amounted to $33,203,769, as compared with $29,853,403 for the preceding year, and operating expenses (including current maintenance, taxes and reserve for renewals and replacements) totaled $20,522,903 against $19,212,490. The increase in operating expenses was due entirely to the increased volume of business. Gross income amounted to $13,004,082 in 1925 against $11,083,627 in 1924, and net income, after interest charges and amortization of debt discount and expense, to $8,113,541 against $7,238,271 in 1924.

During the year the over-all increase in customers amounted to 51,427, making a total of 412,104 customers connected to the system as of Dec. 31, 1925. The physical property of the system was materially improved and extended during the past year.

Minnesota Utility to Increase Capitalization.—The Northern States Power Company of Minnesota has filed an amendment to its articles of incorporation providing for an increase of $10,000,000, from $80,000,000 to $90,000,000, in its authorized capital. As explained by Robert F. Pack, vice-president and general manager of the company, the increase was decided upon by the directors to bring the power company's capital up to the level of the authorized capital of the Northern States Power Company of Delaware, a holding corporation which owns all of the stock in the Northern States Power Company of Minnesota, the operating company. None of the stock of the Minnesota company is to be offered to or held by the public and the new stock of $10,000,000, when issued, will be taken over by the Delaware concern whose securities are available for public purchase.

General Electric to Split Stock

The board of directors of the General Electric Company at a meeting on April 23 approved and recommended a plan to change the present 1,850,000 shares of authorized common stock of a par value of $100 each into 7,400,000 shares of common stock without par value. The stockholders of the company will vote on the proposition at the annual meeting in Schenectady on May 11, a two-thirds affirmative vote of the stockholders being necessary for authorization.

Each stockholder will receive four shares of the proposed no-par stock for each share of present holdings. Provided the stockholders authorize the change, the directors propose to pay on July 15 a quarterly dividend of 75 cents per share in cash on the new common stock and an annual dividend of $1 per share in special 6 per cent stock of the company (such stock dividend taking the place of the stock dividend paid in October of each of the last four years).

Standard Gas & Electric Revamps Set-Up

Enlarged System Includes Philadelphia Company, and Gross Utility Earnings Now Equal Over $137,000,000—Structure Is Simplified

BY PAUL WILLARD GARRETT
Financial Editor New York *Evening Post*

ONE of the most interesting pieces of public utility financing of the year is that now in the process of completion by the Standard Gas & Electric Company. This large Byllesby organization proposes through its subsidiary, the Standard Power & Light Corporation, to do two distinct things—(1) greatly to enlarge its sphere of utility management through the addition of new and important units and (2) to simplify the capital structure.

The first step in the plan involved the acquisition of control of the Standard Power & Light Corporation, and on completion of present plans Standard Gas & Electric will hold 80 per cent of the voting control of that corporation as against a 50 per cent interest heretofore. Through an exchange of its own securities Standard Gas & Electric Company proposes to obtain for its subsidiary, the Standard Power & Light Corporation, the minority stocks of certain companies in which the corporation already has a majority of interest.

To the common stockholders of the Philadelphia Company, for example, Standard Gas & Electric offers 1⅛ shares of its own stock for each share of Philadelphia Company; to preferred stockholders, including holders of voting-trust certificates, of Pittsburgh Utilities Corporation, it offers an exchange on another basis. Offers of exchange also are made to the common stockholders of the United Railways Investment Company and to the prior preference stockholders of the California Railway & Power Company.

The enlarged Standard Gas & Electric Company will become one of the world's largest utilities, with its combined gross earnings from operated and affiliated utility companies of more than $137,000,000, which, if account were taken of the Shaffer Oil & Refining Company, would be swelled to $152,000,000 for the entire system. The principal utility companies of the Standard Gas & Electric group are: California Oregon Company, Coast Valleys Gas & Electric Company, Fort Smith Light & Traction Company, Louisville Gas & Electric Company, Market Street Railway Company, Mountain States Power Company, Northern States Power Company and subsidiaries, Oklahoma Gas & Electric Company, Philadelphia Company, which in turn owns the Duquesne Light Company and the Equitable Gas Company and the Pittsburgh Railways Company; San Diego Consolidated Gas & Electric Company, Sierra & San Francisco Power Company, Southern Colorado Power Company, Western States Gas & Electric

Company, Wisconsin Public Service Corporation and others. The combined assets of the operated and affiliated utility companies are in excess of $750,000,000.

That the proposed exchange will benefit stockholders of Standard Gas & Electric as well as stockholders now asked to join in the move is a calculation made on the basis of new economies of operation. Furthermore, the issuance of additional Standard Gas & Electric stock to make the exchange possible does not threaten to dilute the values back of that sound utility stock. Upon completion of all the exchanges of the stocks of utility companies serving the Pittsburgh district and San Francisco the annual earnings on Standard Gas & Electric Company's common stock should be not less than $6 per share, or twice present dividend requirements.

Mohawk-Hudson to Acquire Eastern New York Utilities.—Application has been made by the Mohawk-Hudson Power Corporation to the Public Service Commission of the State of New York for consent to acquire a majority of the stock of the Eastern New York Utilities Corporation of Rensselaer through exchange of stock. It is proposed to give one-half share of preferred stock and one-half share of second preferred stock of the Mohawk-Hudson Power Corporation for one share of preferred stock of the Eastern New York Utilities Corporation and to give one-third share of second preferred stock and two shares of common stock of Mohawk-Hudson for each share of common stock of the Rensselaer company. The petition sets forth that the stock of the Eastern New York Utilities Corporation consists of 8,000 shares of prior preferred stock, without par value; 20,290 shares of preferred stock of $100 par value, and 13,750 shares of common stock of $100 par value. In support of its petition the Mohawk-Hudson Corporation says that it already owns a majority of the capital stock of companies supplying the Eastern New York Utilities Corporation and that acquisition of the stock will further the general policy of the various electric corporations producing, distributing and selling electrical energy to different parts of the state contiguous to each other in one corporate body, leaving, however, the local corporations as separate operating entities.

Dividends Declared

The quarterly dividends listed below were recently announced by electric light and power and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
American Superpower, pfc. pf	.50	May 15
American Water Works & Elec. com.	1¼	May 15
American Water Works & Elec., pf.	1¾	May 15
Broad River Power, pf.	1¾	May 1
Cahfornia-Oregon Power, pf.	1¾	April 30
Cambridge Electric Light	$1	May 1
Cedar Rapids Mfg. & Power	¾	May 15
Cent. & Southwest Util., pf. & pr. ln	$1.75	May 15
Central Power & Light, pf.	$1.75	May 1
Cities Service, com.*	½	June 1
Cities Service, com.†	½	June 1
Cities Service, pf. and pf. B*	½	June 1
Columbia Gas & Electric, com.	$1.25	May 15
Columbia Gas & Electric, pf.	1¾	May 15
Community Pwr. & Light, 1st pf.	1¾	May 1
Community Power & Light, 2d pf.	2	June 1
Conn. Ry. & Lt., com. & pf.	1¼	May 15
Consumers Power, 6% pf.	$1.50	July 1
Consumers Power, 6.6% pf.	$1.65	July 1
Consumers Power, 7% pf.	$1.75	July 1
Consumers Power, 6% pf.*	.50	May 1
Consumers Power, 6% pf.*	.50	June 1
Consumers Power, 6% pf.*	.50	July 1
Consumers Power, 6.6% pf.*	.55	May 1
Consumers Power, 6.6% pf.*	.55	June 1
Consumers Power, 6.6% pf.*	.55	July 1
Cumberland Co. Pwr. & Lt., pf.	1¾	May 1
Dallas Power & Light, pf.	1¾	May 1
Electric Investors, Inc., $7 pf.	$1.75	May 1
Electric Investors, Inc., $6 pf.	$1.50	May 1
Electric Refrigeration	.50	May 1
Electric Refrigeration‡	1¼	May 1
Eureka Vacuum Cleaner	$1	May 1
Forth Worth Power & Light, pf.	1¾	May 1
Idaho Power, pf.	1¾	May 1
Knoxville Power & Light, pf.	$1.75	May 1
Lawrence Gas & Electric	2½	May 1
Long Island Lighting, com.	.50	May 1
Montpelier & Barre Lt. & Pwr., com.	.50	April 15
Montpelier & Barre Lt. & Pwr., pf.	1¾	April 15
Montpelier & Barre Lt. & Pwr., pr. pf.	1¾	April 15
Montreal Light, Heat & Power	2	May 15
National Power & Light, com.	.10	June 1
Northern N. J. Utilities, pf.	1¾	May 1
Northwest Utilities, pf.	$1.75	May 15
Pacific Gas & Electric pf.	1¾	May 15
Pacific Power & Light, pf.	1¾	May 1
Portsmouth Power, pf.	1¾	May 1
Rome Wire, A	.75	May 1
Rome Wire, B	.25	May 1
Southern Colorado Power, A	.50	May 25
Standard Power & Light, pf.	$1.75	May 1
Tampa Electric, com.	.50	May 15
Texas Power & Light, pf.	1¾	May 1
Tri-State Utilities, com.*	½	May 10
Wabash Valley Electric, pf.	1¾	.....

*Monthly.
†Payable in com. stock.
‡Payable in stock.

Central Stations Raise $162,931,000 in April

During the month of April the electric light and power companies of the country offered new stock, bond and note issues to the amount of $162,931,000, as compared with $47,108,000 recorded for April, 1925. Two unusually large offerings contributed substantially to this total, the $65,000,000 issue of the Associated Electric Company and the $35,000,000 issue of the Appalachian Electric Power Company.

Although long-term financing predominated, several short-term issues appeared during the month. Attention is called to the number of companies which entered the market in April to refund outstanding securities. The average yield, which declined from 6.10 per cent in February to 5.55 per cent in March, made a recovery to the 5.73 per cent mark.

Electric Refrigeration Corporation Issues First Quarterly Statement. — The Electric Refrigeration Corporation has issued its first quarterly statement since it was organized early this year. The net profit before federal taxes for the first quarter of the company's incorporation was $969,885, as against a consolidated profit of the Kelvinator

Security Issues of Electric Service Companies in April

Name of Company	Amount of Issue	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Southeastern Power & Light Co.	$7,880,000	..	Cumulative preferred stock	Additions to properties and for other corporate purposes	7	98½	7.10
Associated Electric Co.	65,000,000	20	Convertible gold bonds	To retire outstanding securities	5½	95½	5.90
Electric Public Service Co.	700,000	15	Secured gold bonds, series A	To retire short-term indebtedness and for other corporate purposes	6	96	6.40
Eastern New Jersey Power Co.	1,350,000	23	First mortgage gold bonds	To reimburse company for expenditures incurred for additions and improvements	5½	97½	5.70
Pittsburgh Utilities Corp.	10,000,000	2	First lien gold notes	To refund maturing bonds	5	100	5
Central Gas & Electric Co.	6,500,000	20	First lien collateral trust sinking-fund gold bonds	To retire outstanding securities, for the acquisition of property and for other corporate purposes	6	98½	6.15
	2,016,000	..	Preferred stock	To retire present outstanding securities for the acquisition of property and for other corporate purposes	7	96	7.29
	1,500,000	3	Gold notes	To retire present outstanding securities, for the acquisition of property and for other corporate purposes	6	99½	6.30
Lake Erie Power & Light Co.	500,000	20	First and refunding mortgage sinking-fund gold bonds, series A	Acquisition of properties	6	98½	6.10
Puget Sound Power & Light Co.	5,000,000	5	First and refunding mortgage gold bonds, series B	.....	5	99½	5.10
Virginia Public Service Co.	5,000,000	20	Sinking-fund gold debentures	.....	6	96½	6.30
Jersey Central Power & Light Co.	1,000,000	20	First mortgage and refunding sinking-fund gold bonds, series A	.....	5½	97½	5.70
Broad River Power Co.	1,485,000	28	First and refunding mortgage gold bonds, series A	.....	5	92	5.55
American Power & Light Co.	10,000,000	90	Gold debenture bonds	.....	6	98	6.10
Appalachian Electric Power Co.	35,000,000	30	First and refunding mortgage gold bonds	Acquisition of properties	5	97	5.20
Pacific Gas & Electric Co.	10,000,000	29	First and refunding mortgage gold bonds	.....	5	98½	5.10
Total	$162,931,000						

Corporation, Nizer Corporation and Grand Rapids Refrigerator Company of $664,193 for the corresponding period of 1925. After due allowance for federal taxes, this is equivalent to $1.47 per share on the 571,250 shares outstanding, as against $1 in 1925, an increase of approximately 50 per cent in the net per share. As of March 31 current assets totaled $9,386,045.

Aluminum Company's Purchase of Duke-Price Interests Fianaced by Bond Issue.—To further the transaction whereby the Aluminum Company of America acquires control of the Duke-Price Power Company, Ltd., details of which are given on page 938 in this issue, an offering of bonds, amounting to $37,000,000, was made on Thursday. These first mortgage sinking fund gold bonds, series A, of the Duke-Price Company were priced at 100 and accrued interest, to yield 6 per cent and mature May 1, 1966. The company's outstanding $12,000,000 first mortgage 6 per cent bonds due 1949, which will be called for redemption July 1, will be accepted in payment for the new bonds on a 4½ per cent interest yield basis.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday April 24	Low 1926	High 1926
STOCKS			
ABITIBI PWR. & PAPER, com.			
—no par	75	71¼	84½
Adirondack Pwr. & Lt.—7% pf.	k101	....	....
Adirondack Pwr. & Lt.—8% pf.	109	108	110
Adirondack Pwr. & Lt., com.—50	m 75	n 31	n 98
Ala. Pwr., pf.	k103½	....	....
Allis-Chalmers Mfg. pf.	k109	105	110
Allis-Chalmers Mfg., com.	k 83	78¼	94½
Aluminum Co. of Amer., com.	k 64	....	....
Aluminum Co. of Amer. new, pf.	k 93	....	....
Amer. & Foreign Pwr., pf. 25% pd.	m108	108	131
Amer. & Foreign Pwr., 7% pf.—no par	c 90½	89	98
Amer. & Foreign Pwr., com.—no par	k 20½	17	42½
Amer. Bosch Magneto, com—no par	21½	19½	34½
Amer. Brown Boveri, Elec.	k 35½	30½	48½
Amer. Brown Boveri Elec. pf.	k 94½	86½	97½
Amer. Elec. pwr., pf.	c111½	101¼	111½
Amer. Gas & Elec., 6% pf.—no par.	k 91	90½	95½
Amer. Gas & Elec., com.—no par.	k 73	64	99½
Amer. Lt. & Trac., 6% pf.	105	114½	115½
Amer. Lt. & Trac., com.	m204	195	263
Amer. Pwr. & Lt., 6% pf.	k 93½	92	94
Amer. Pwr. & Lt., com.—no par.	k 54½	48½	79½
Amer. Pub. Serv., 7% pf.	k 94	....	....
Amer. Pub. Serv., com.	47	45	80
Amer. Pub. Utilities, 4% pf.	k 82	....	....
Amer. Pub. Utilities, 6% pf.	k 86	....	....
Amer. Pub. Utilities, 7% pf.	86	88	92
Amer. Pub. Utilities, com.	70	80	82
Amer. States Sec., A	k 2½	....	....
Amer. States Sec. B	k 1½	....	....
Amer. Superpwr., pf.—25	24½	23	26½
Amer. Superpower, pf.	90	90	94
Amer. Superpwr., Class A—no par.	k 24½	19½	37½
Amer. Superpwr., Class B—no par.	24½	21½	39
Amer. Wtr. Wks. & Elec., 7% pf.	k104½	101½	108½
Amer. Wtr. Wks. & Elec., com.—20.	k 51½	43½	74
Anaconda Copper	k 44½	41½	51
Appalachian Pwr., 7% pf.	100	99	101
Appalachian Pwr., 1st pf., 7%	100	99	101
Appalachian Pwr., com.	80	80	83
Arizona Pwr., 7% pf.	k 75	....	....
Arizona Pwr., com.	m 27	27	35½
Arkansas Cent. Pwr., pf., $7—no par	102	99	102
Arkansas Lt. & Pwr., 7% pf.	k 96	....	....
Arkansas Lt. & Pwr., com.	100	110	115
Asheville Pwr. & Lt., 7% pf.	l102	100½	104
Assoc. G.&E., pf.—$3.50—50	k 50	....	....
Assoc. Gas & Elec., pf.—$6—no par	k 82½	....	....
Assoc. Gas & Elec., Class A—no par	k 29½	25½	35½
BABCOCK & WILCOX, com.	k117	120	149
Binghamton Lt., Ht. & Pwr., pf.	105	....	....
Birmingham Elec. pf.—$7—no par.	101	101	103½
Blackstone Valley Gas & Elec., pf.	90	90	106
Blackstone Valley G.&E., com.—50.	90	....	....
Blaw-Knox, com.	m 48	45	56
Brazilian Trac., Lt. & Pwr., com.	f 88½	....	....
Broad River Pwr., pf.	k 93	....	....
Brooklyn Edison, com.	k139	133	146½
Buffalo Gen. Elec., com.—no par.	m 58	n 50	n 77
Buffalo, Niagara & East. Pwr., pf.—25	k 24½	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par	k 24½	....	....
CALIFORNIA ELEC. GENERATING, pf.	90	89	93
California Ry. & Pwr., pf.	100	88	115
Carolina Pwr. & Lt., pf.—$7—no par	103	102	107
Carolina Pwr. & Lt., com.	m420	n290	n456½
Cent. & S. W. Ut. 7% pf.—no par	a 95	89½	95
Cent. & S. W. Ut., pr. ln. pf.—no par	a 99½	95½	100
Central Ariz. Lt. & Pwr., pf.	102	....	....
Central Ark. Ry. & Lt., 7% pf.	k 98	....	....
Central Ill. Pub. Serv., 6% pf.	88	89	91
Central Ind. Pwr., 7% pf.	88	88	93½
Central Pwr. & Lt., pf.	94	94	98½
Central States Elec., 7% pf.	k 93	....	....
Central States Elec., com.	m200	200	230
Century Elec., com.	b115	110	116
Chicago Fuse Mfg., com., no par.	31	30½	35
Cincinnati Gas & Elec., com.	g 90½	88	95½
Cities Service, 6% pf.	k 84½	....	....
Cities Service, pf. B—10.	k 7½	....	....
Cities Service, pf. BB—100.	k 74	....	....
Cities Service, com.—20.	k 41½	....	....
Cities Service, Bkrs. Shrs.—10.	k 19½	....	....
Clarion River Pwr., pf.	93	93	95
Cleveland Elec. Illg., 6% pf.	104	103	105½
Cleveland Elec., Illg., com.	k225	....	....
Colorado Pwr., 7% pf.	k 96	....	....
Columbia Gas & Elec., 7% pf.	k114	112	115
Columbia Gas & E., com.—no par.	k 78½	63½	90
Columbia Ry., Gas & Elec., 6% pf.	95	95	96
Columbus Elec. & Pwr., 2d pf.	k102	....	....
Columbus Elec. & Pwr., com.	k185	....	....
Columbus Ry., Pwr. & Lt., 1st. pf.	97	98	99
Columbus Ry., Pwr. & Lt., pf. B.	95	92	95
Col. Ry., Pwr. & Lt., com.—no par.	82	82	85
Commonwealth Edison, com.	a139	137½	144
Commonwealth Pwr., 6% pf.	k 84½	82	87½
Commonwealth Pwr., com—no par.	k 35	28½	42½
Conn. Lt. & Pwr., 8% pf.	116	117	121
Conn. Lt. & Pwr., 7% pf.	108	108	113
Cons. Gas of N. Y., pf.—50.	k 87	....	....
Cons. Gas of N.Y., com.—no par.	k 92½	87	104½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	104	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti 6½% pf.	c110	108½	110
Cons. Gas, Elec. Lt. & Pwr. of Balti.. 7% pf.	c112	109	115½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	c126	124	128½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par	c 50	45	57½
Cons. Utilities of Dela., 7% pf.	m 85	n 80	n 84
Consumers Pwr., 6% pf.	96	95	98
Consumers Pwr., 6.6% pf.	102	101½	103½
Continental Gas & Elec., 7% ptc. pf	k 97	....	....
Continental Gas & Elec., 7% pr. pf.	k 93½	....	....
Continental G.&E., com.—no par.	100	85	150
Crocker Wheeler, com.	14	14	19
Crocker Wheeler, pf.	50	50	55
DALLAS PWR. & LT., 7% pf.	102	102	104
Dayton Pwr. & Lt., 6% pf.	98	95	97
Dayton Pwr. & Lt., com.	m420	n180	n460
Detroit Edison, com.	133½	123½	141½
Dubilier Condenser & Radio, com. no par.	k 4½	4½	11
Dubuque Elec., 6% pf.	95	93	97
Duquesne Lt., 7% pf.	k116½	111½	114
EAST. N. Y. UTIL. pf.	80	80	85
Eastern New York Util., com.	65	70	75
Eastern States Power.	17	23	32½
Eastern States Pwr., pf.	k 86	....	....
Eastern Tex. Elec., 7% pf.	k102	....	....
East. Tex. Elec., com.—no par.	102	103	107
Edison Elec. Illum. of Boston, com.	d215	207	250
E. Paso Elec., com.—no par	300	290	318
E. Paso Elec. pf.	101	102	104
Elec. Bond & Share, 6% pf.	l106	103½	107½
E. Bd. & Share Sec., com.—no par.	l 68	56½	86
El. Household Util., com—10	a 18½	16½	25
Elec. Investors, 6% pf.—no par.	89	92	95
Elec. Investors, com.—no par.	k 39	30½	74½
Elec. Investors, 10% pf. receipts.	16	....	....
Elec. Pwr. & Lt., ctfs., pf.	k 93½	89½	97½
Elec. Pwr. & Lt., ctfs. 40% pd	102½	99½	115
Elec. Pwr. & Lt., ctfs. full pd.	105	103	110½
Elec. Pwr. & Lt., ctfs., com.—no par	k 20½	17½	34½
Elec. Ry. Securities, com.—no par.	k 6	4½	10
Elec. Refrig.	k 63½	52½	90½
Elec. Storage Battery, com.—no par.	k 77½	71½	79½
Elmira Wtr., Lt. & R. R., 7% pf.	97	97½	99½
Emerson Elec. pf.	m102½	100	104½
Empire Dist. Elec., 6% pf.	80	80	85
Empire Pwr., A.	k 22½	22½	32
Eng. Pub. Serv., pf.—no par.	97½	99½	104½
Engr. Pub. Serv., com.—no par.	k 22½	21	29½
Eureka Vac. Cleaner, com.—no par.	47	45	53½
FAIRBANKS MORSE, com—no par	49½	46	59½
Fairbanks Morse, pf.	116	108½	115
Federal Lt. & Trac., com.	30½	28	39½
Federal Light & Traction, pf.	87	87	89
Federal Utilities, pf.	70	....	....
Federal Utilities, com.	k 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	k104½	105	108
GALVESTON-HOUSTON ELEC., 6% pf.	k 45	....	....
Galveston-Hstn El., com.	k 15	....	....
Gen. Elec., w.i.	k 81½	80½	82
Gen. Elec., com.	k320	285	386½
Gen. Elec., special—10.	k 11½	11	11½
Gen. G.&E., (Del.) com. A no par.	k 36½	34	59
Gen. G.&E., (Del.) com. B no par.	k 27	....	....
Gen. G.&E., (Del.) A pf. $8—no par	108	105½	110½
Gen. G.&E., (Del.) A pf. $7—no par	96½	95	99½
Gen. G.&E., (Del.) B pf.	95½	93½	96
General Public Service, pf.	k100	100	106½
General Public Service, com.	12½	12½	16½
Ga. Lt., Pwr & Rys., 6% pf.	80½	82	85
Ga. Lt., Pwr. & Rys., com.	m 57½	56½	73½
Ga. Ry. & Elec., 5% pf.	m 70	n 78½	n 84½
Ga. Ry. & Elec., com.	m110	n115½	n115½
Ga. Ry. & Pwr., 8% pf.	112	112	114
Ga. Ry. & Pwr., 7% pf.	100	101½	103
Ga. Ry. & Pwr., 4% pf.	m133	....	....
Ga. Ry. & Pwr., com.	k110	....	....
Gt. Western Pwr., 7% pf.	h100½	....	....
HAVANA ELEC. UTIL., com.	m 38½	37½	44½
Havana Elec. Util., pf.	70½	64½	71½
IDAHO PWR., 7% pf.	101	103	104
Ill. No. Utilities, 6% pf.	90	88	92
Ill. Pwr. & Lt., 7% pf.	k 97	....	....
Ingersoll Rand.	k 91½	80½	105
Int. Combus. Engr., com.—no par.	k 47½	33½	64½
Int. Utilities, class A—no par.	k 32	....	....
Int. Utilities, class B—no par.	k 5½	4½	9½
Interstate Pwr., pf., $7 no par.	k 92	....	....
Interstate Pub. Serv., 7% pf.	95	96½	97
Iowa Ry. & Lt., 7% pf.	95	98	100
JERSEY CENTRAL PWR. & LT. 7% pf.	95	95½	96½
Jersey Central Pwr. & Lt., com.—no par	45	45	50
Johns-Manville, com.—no par.	137½	130	152½
KANSAS CITY PWR. & LT., pf.	108	107½	111
Kansas Gas & Elec., 7% pf.	l100½	99	102
Kentucky Hydro-Elec., pf.	a 93½	91½	95
Kentucky Sec., 6% pf.	k 75	75	77
Kentucky Sec., com.	k100	90	100
Kentucky Utilities, 6% pf.	92	90	95
Keystone Pwr. & Lt. 7% pf.	94	95	97
Kings County Ltg., 7% pf.	100½	101	106
Kings County, Ltg., 8% pf.	103	105	108
LACLEDE GAS LT., com.	155½	146	168
Lehigh Pwr. Sec., com.—no par.	k 13½	10	23
Long Island Ltg., 7% pf.	103	105	107
Long Island Ltg., com.—no par.	110	120	150
Los Angeles Gas & Elec., 6% pf.	k 96	....	....
Louisville Gas & Elec., Class. A	23½	22½	26½
MANHATTAN ELEC. SUPPLY.	k 72½	56	76½
Manila Elec., com.—no par.	33	27½	35
Maytag Mfg., com.	k 20½	19	23½
Memphis Pwr. & Lt., pf., $7, no par	102	103	105
Metro. Edison, pf.—$6—no par.	k 91½	....	....
Metropolitan Edison, pf., $7, no par.	102	102	106
Metropolitan Edison, com., no par.	45	45	50
Middle West Utilities, 7% pf.	a104½	97½	111½
Middle West Utilities, 7% pr. lien pf.	a114½	106½	123½
Middle West Utilities, com.—no par.	a112½	109	134½
Midland Utilities, pr. ln. pf.	a 98½	98	100
Midland Utilities pf. A	a 96	96	98
Milwaukee Elec. Ry. & Lt., 7% pf.	100	....	....
Milwaukee Elec. Ry. & Lt., 6% pf.	91	....	....
Minn. Pwr. & Lt., 7% pf.	l 99½	100	103½
Miss. Pwr. & Lt., pf.	k101	....	....
Miss. River Pwr., 6% pf.	93	94	96
Miss. River Pwr., com.	k 60	....	....
Mohawk Hudson Pwr., 1st pf.—$7—no par.	100	101	105
Mohawk Hudson Pwr., 2nd pf.—$7—no par.	95	90	97
Mohawk Hudson Pwr., com.—no par	m 23½	21½	28½
Montana Pwr., pf.	m114½	112½	119½
Montana Pwr., com.	k 76½	69½	83½
Montreal Pwr., com.	f 222½	....	....
Mountain States Pwr., pf.	k 96	....	....
Mountain States Pwr., com.	k 20	....	....
NASSAU & SUFFOLK, LTG., pf.	92	93	95
National Carbon, com.	m124	n120	n130
National Carbon, pf.	a127	125	128
National Elec. Pwr., pf.	m 91	93	95
National Electric Pwr-A	a 20½	19½	26
Nat.-Lt., Ht. & Pwr., com.—no par.	24	22	25
National Lt., Ht. & Pwr., 5% pf.	72	71	73
National Pwr. & Lt., pf., $7—no par.	k 98½	96	102½
National Pwr. & Lt., com.—no par.	k 20½	16½	38½
National Pub. Serv., 7% pf.	91	90	94
National Pub. Serv., ptc. pf.	95	96	97½
National Pub. Serv., A com.—no par	21	15½	24
National Pub. Serv., B com.—no par	12½	10	12½
Nebraska Pwr., 7% pf.	l102½	103	105½
Nevada-Calif. Elec., com.	m 23	18½	44½
New Brunswick Pwr., pf.	25	30	40
New England Pub. Serv., pr. ln. pf.	98	98	99½
New England Pub. Serv., pf.	88	95½	97
N. J. Pwr. & Lt., 7% pf.	105	104	108
New Orleans Pub. Serv., 7% pf.	98½	100	102
New Orleans Pub. Serv., com.—no par.	m 30	n 31	n 38½
N. Y. Central Elec., 7% pf.	m 97	98	100
Newport News & Hampton Ry., Gas & Elec., com.	110	108	112
Newport News & Hampton Ry., Gas & Elec., pf.	110	109	114
Niagara Falls Pwr., 7% pf.—25.	k 28½	27½	28½
Niagara, Lock. & Ont. Pwr., 7% pf.	108	110	111½
Niagara, Lock. & Ont. Pwr., com.—no par.	m 60½	n 60	n 73
No. Amer., 6% pf.—50.	49½	49	50½
No. Amer., com.—10.	k 49½	42	67
No. Amer. Edison pf.—no par.	91	93	95
No. Amer., Lt. & Pwr., pf.	90	88	90
N.C. Pub. Serv., pf.—$7—no par.	k 90	....	....
Northeastern Pwr., com.	k 20½	17½	36½
No. Indiana Gas & Elec., pf. A.	m 97	98	100
No. N. Y. Utilities, 7% pf.	k102½	....	....
No. Ohio Pwr., com.—no par.	k 15	11	26½
No. Ohio Trac. & Lt., 6% pf.	76	78	81
No. Ohio Trac. & Lt., 7% pf.	86	88	91
No. Ont. Lt. & Pwr., pf.	k 78	....	....
No. Ont. Lt. & Pwr., com.	73	45	70
No. States Pwr., 7% pf.	k101	99½	101½
No. States Pwr. com.	k103½	97	136½
No. Texas Elec., 6% pf.	k 45	....	....
No. Texas Elec., com.	k 25	....	....
OHIO BRASS, com. B—no par.	74	70	79
Ohio Brass, pf.	100	98	101
Ohio Gas & Elec., 7% pf.	90	92	95
Ohio Pwr., 6% pf.	94	93	95
Ohio Pub. Serv., 6% pf.	90	90	93
Ohio Pub. Serv., 7% pf.	99½	98½	100
Ohio River Edison, pf.	99½	99½	101½
Oklahoma Gas & Elec., pf.	k 96	....	....
PACIFIC GAS & ELEC., 6% pf.	k 98	....	....
Pacific Gas & Elec. com.	k123½	118	132½
Pacific Pwr. & Lt., 7% pf.ex.	l 98	98	101½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, April 27. lBid, low, high, Wednesday, April 28. mLatest quotations available. n1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday April 24	Low 1926	High 1926
STOCKS—Continued			
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Central Lt. & Pwr., pf.—no par	*c* 72½	71	91
Penn-Ohio Elec., 7% pf.	95	93	96
Penn-Ohio Pwr. & Lt., 7% pf.	97	94	97
Penn-Ohio Pwr. & Lt., 8% pf.	102	100	106
Penn Pwr. & Lt.—$7—no par.	*l*104½	103	106½
Penn Pub. Serv., 7% pf.	99	96	100
Penn Pub. Serv., 6% pf.	86	85	90
Penn Wtr. & Pwr., com.	*e*144	150	171
Phila. Co., 6% pf.—50.	*k* 49	47½	50½
Phila. Co., com.—50.	*k* 73½	59½	76½
Phila. Elec., com.—25.	*c* 46½	41½	67½
Pittsburgh Utilities, pf.—10.	*k* 19¼	14½	19½
Portland Elec. Pwr., 7% pf.	96	97	98
Portland Elec. Pwr., 6% pf.	72	71	75½
Portland Elec. Pwr., com.	*k* 36	....	....
Portland Ry., Lt. & Pwr.,pf.	*m* 72½	....	....
Portland Ry., Lt. & Pwr., com.	*m* 49	....	....
Potomac Elec. Pwr., pf.	*j*107	....	....
Pwr. Corp. of N. Y., 7% pf.	*m*110	*n* 96	*n*112
Pwr. Corp. of N.Y., com—no par.	*m* 79	77½	90½
Pwr. Sec., pf.—no par.	*k* 14	....	....
Pwr. Sec., com.—no par.	*k* 5	....	....
Pub. Serv. of N. J., 7% pf.	106	103½	108½
Pub. Serv. of N. J., 8% pf.	117½	115	119
Pub. Serv. of N. J., com.—no par.	*k* 78½	72	92½
Pub. Serv. of No. Ill., 6% pf.	*a*102	100½	103
Public Serv. of No. Ill., 7% pf.	*a*114	112	116½
Pub. Serv. of No. Ill., com.—no par	*a*129	128½	137
Pub. Serv. of No. Ill., com.	*a*128½	128½	131½
Pub. Serv. of Okla., 7% pf.	96	92	95
Pub. Serv. Elec. & Gas, 6% pf.	*k* 99½	97	99½
Puget Sound Pwr. & Lt., 7% pf.	*k*106	....	....
Puget Sound Pwr. & Lt., 6% pf.	*k* 83	....	....
Puget Sound Pwr. & Lt., com.	*k* 49	....	....
RADIO CORP. OF AM., pf.—50.	45½	44½	47½
Radio Corp. of Amer., com.—no par	*k* 36½	32	46½
Republic Ry. & Lt., pf.	*k*103	....	....
Republic Ry. & Lt., com.	*k* 82	....	....
Rochester Gas & Elec., 5% pf.	*m* 95	80	98
Rochester Gas & Elec., 6% pf.	101½	100	102
Rochester Gas & Elec., 7% pf.	104½	105	107
ST. JOSEPH RY., LT., HT. & PWR., pf.	65	60	65
Servel Corp., Class A	*k* 24½	15½	30½
Servel Corp., Class B—no par.	*k* 44	....	....
Sierra Pacific Elec., com.	*k* 25½	23	28½
Sioux City Gas & Elec., 7% pf.	97	96	98
S. E. Pwr. & Lt., pf —$7—no par.	98	97	100
S. E. Pwr. & Lt., com.—no par.	*k* 29½	20	46½
So. Calif. Edison, 8% pf.	130	135	140
So. Calif. Edison, 7% pf.	*k*109	....	....
So. Calif. Edison, 6% pf.	*k* 97	....	....
So. Calif. Edison, com.	*k*119½	115½	142
Southern Cities Utilities, 7% pf.	*k* 85	....	....
Southern Cities Utilities, com.	*k* 31	....	....
Southern Pwr. & Lt. of Md., pf.	*m*107	....	....
Southern Pwr. & Lt. of Md., com.	*m* 32	....	....
Southwestern Lt. & Pwr., A.	*k* 55	....	....
Southwestern Lt. & Pwr., B.	*k* 45	....	....
Southwestern Lt. & Pwr., $6 pf.	*k* 81	....	....
Southwestern Pwr. & Lt., 7% pf.	*k* 98	....	....
Springfield (Mo.) Ry. & Lt., 7% pf.	95	....	....
Standard Gas & Elec., 8% pf.	*k* 55½	53½	57½
Standard Gas & Elec., 7% pf.	*k* 99	....	....
Standard Gas & Elec., com.—no par.	*k* 54	51	69
Standard Pwr. & Lt., 7% pf.	*k* 92	....	....
Superheater, com.—no par.	*k*145	132	145
Syracuse Lighting, 7% pf.	102	105	107
Syracuse Lighting, 8% pf.	118	....	....
Syracuse Lighting, com.	285	260	315
TAMPA ELEC., com.	*k*270	....	....
Tenn. Elec. Pwr., 6% pf.	*k* 85	....	....
Tenn. Elec. Pwr., 7% pf.	*k* 98	....	....
Tenn. Elec. Pwr., pf.—$6—no par.	*m* 80	....	....
Tenn. Elec. Pwr., com.—no par.	*m* 65	....	....
Terre Haute, Ind. & East Trac., pf.	20	23	37
Terre Haute, Ind. & East. Trac., com	3	3	5
Tex. Pwr. & Lt., 7% pf.	*l*102½	102	105
Tide Water Pwr., 8% pf.	*k*101	....	....
Timken Roller Bearing, com—no par	*k* 50½	44½	56½
Toledo Edison, 8% pf.	111	112	114
Toledo Edison, 7% pf.	101	101	103
Toledo Edison, com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	88½	87½	89
UNITED GAS & ELEC., 6% pf.	94	94	97
United Gas & Elec., com.—no par.	*m*57	56	66
United Gas & Elec. (N.J.), 5% pf.	*k* 68	70	75
United Gas Impr.—50.	*c* 94½	84½	144½
United Lt. & Pwr., pf.—$4—no par.	44	....	51
United L. & P. pf.—$6.50—no par.	85	81	91
United Lt. & Pwr., com., A—no par	67	63½	143½
United Lt. & Pwr., com., B—no par	60	140	165
Utah Pwr. & Lt., 7% pf.	*l*100½	99	103½
Utica Gas & Elec., 7% pf.	104	103	105
Utica Gas & Elec., com.	200	....	....
Utilities Pwr. & Lt., 7% pf.	*k* 94	....	....
Utilities Pwr. & Lt., com. B—no par.	14½	14	18
VERMONT HYDRO - ELEC., 7% pf.	94	95	96
Virginian Pwr., 7% pf.	107	102	104
Virginian Pwr., com.	65	....	....
Virginia Ry. & Pwr., com.	*m*150	150	150
WAGNER ELEC., pf.	*b* 75	70	80
Wagner Elec., com.—no par.	*b* 22	20	34½
Washington Ry. & Elec., com.	*j*205	....	....
Washington Ry. & Elec., pf.	*j* 90½	....	....
Washington Wtr. Pwr., com.	127	130	134
West Mo. Pwr., 7% pf.	*k* 91	....	....
West Penn., 7% pf. temp. ctfs.	*m* 99	95½	101
West Penn, com.	*m*125	118	130
West Penn Elec., pf.	*k* 96½	96½	100½
West Penn Elec., Class A	*k* 92	88½	97
West Penn Pwr., pf.	110	108	112
West Va. Lt., Ht. & Pwr., 7% pf.	95	95	98
West Va. Utilities, 7% pf.—50.	42	43	45
Western Pwr., 7% pf.	*k* 93	....	....
Western Pwr., com.—no par.	*m* 80	*n* 34	*n*102
Western States Gas & Elec., 7% pf.	*k* 90	....	....
Western States Gas & Elec., com.	*k* 17	....	....
Westinghouse El. & Mfg., com—50.	*k* 68½	65½	79½
Weston Elec. Instrument, Class. A.	28½	27½	31½
Weston Elec. Instrument, com.	*k* 16	13½	19
Wheeling Elec., pf.	90	91	93½
Wis.-Minn. Lt. & Pwr., 7% pf.	*m* 90	....	....
Wis. Pwr., Lt. & Ht., 7% pf.	90	85	90
Worthington Pump, pf. A	76½	73	80
Worthington Pump, pf. B	55	53	65
Worthington Pump, com.	*k* 25½	20½	44½
YADKIN RIVER PWR., 7% pf ex. div.	*l*103	102	105
Yale & Towne, com.—25.	*c* 62½	60½	64½

BONDS

Companies		Bid Price Saturday April 24	Low 1926	High 1926
ABITIBI PWR., & PAPER	6s	1940 *k*101½	....	....
Adir. Elec. Pwr.	5s	1962 *k*101	....	....
Adir. Pwr. & Lt.	6s	1950 *k*105½	....	....
Adir. Pwr. & Lt.	5s	1930 97½	97	99
Ala. Pwr.	5s	1946 100	99	100½
Ala. Pwr.	5s	1951 98	97	99½
Ala. Pwr.	6s	1951 104½	104½	105½
Ala. Trac., Lt. & Pwr.	5s	1962 *m*111	112	124
Aluminum Co. of Amer.	7s	1933 107½	106½	107½
Amer. Bosch Magneto	8s	1936 *m*103	2	....
Amer. Gas & Elec.	5s	2007 93	92	93½
Amer. Gas & Elec.	6s	2014 98½	99	100½
Amer. Pwr. & Lt.	6s	2016 *k* 98	96	98
Amer. Pub. Serv.	6s	1942 99½	98½	100½
Amer. Wtr. Wks. & Elec.	5s	1934 *k* 97½	....	....
Amer. Wtr. Wks. & Elec.	6s	1975 *k* 94½	92½	94½
Anaconda Copper	6s	1929 102½	102½	103½
Anaconda Copper	6s	1953 *k*103½	....	....
Anaconda Copper	7s	1938 *k*105	....	....
Appalachian Pwr.	5s	1941 *k*100	....	....
Appalachian Pwr.	6s	2024 94	93½	95
Appalachian Pwr.	7s	1936 106½	105	106½
Arizona Pwr.	6s	1933 100½	99½	101
Arizona Pwr.	6s	1947 96	95½	97
Ark. Central Pwr.	6s	1948 103	102	103½
Ark. Lt. & Pwr.	6s	1945 *k*104½	....	....
Ark. Lt. & Pwr.	6s	1954 *k*100½	....	....
Assoc. Gas & Elec.	6s	1965 *k* 94½	92½	94½
Assoc. Gas & Elec.	6½s	1954 *k*101	....	....
BERLIN CITY ELEC.	6½s	1928 98½	98	99½
Berlin City Elec.	6½s	1929 97½	97	98½
Binghamtpn Lt., Ht. & Pwr.	5s	1946 *k* 99	....	....
Birmingham Elec.	6s	1954 103½	102½	104
Birmingham Ry., L. & P.	4½s	1954 91½	88	92½
Broad River Pwr.	6½s	1934 100	100	102
Brooklyn Edison	5s	1949 104	103	105½
Brooklyn Edison	6s	1930 105	103½	106½
Buffalo Gen. Elec. 1st	5s	1939 102	101½	102½
Buffalo G. E., 1st & Ref.	5s	1939 101½	101½	102½
Buffalo G. E.	5s	1956 102	99½	102½
Burlington Ry. & Lt.	5s	1932 96½	96	97½
Butte Elec. & Pwr.	5s	1951 *k*100½	....	....
CALIF. ELEC. GEN	5s	1948 *k*100½	....	....
Calif. Gas & Elec.	5s	1937 101½	100½	101½
Calumet Gas & Elec.	5½s	1960 98½	97½	99
Canadian Lt. & Pwr.	5s	1949 60	56	64
Canton Elec.	5s	1937 100½	100	101
Carolina Pwr. & Lt.	5s	1938 100	100½	102½
Carolina Pwr. & Lt.	6s	1953 104½	104½	105½
Cedar Rap. Mfg. & Pwr.	5s	1953 100½	99½	101
Central Ark. Ry. & Lt.	5s	1928 99½	99	100½
Central Ga. Pwr.	5s	1938 95	95	96½
Central Ill. Lt.	5s	1943 *k*100½	....	....
Central Ill. Pub. Serv.	5s	1952 93	92	93½
Central Ill. Pub. Serv.	5½s	1950 97	96	97½
Central Ill. Pub. Serv.	6s	1944 100½	99	101½
Central Ind. Pwr.	6s	1947 99	98	99½
Central Ia. Pwr. & Lt.	6s	1944 99½	99½	101
Central Maine Power	5s	1939 99½	98½	100
Central N. Y. Gas & El.	5s	1941 *k* 98	....	....
Central Pwr. & Lt.	6s	1946 *m*101½	....	....
Central Pwr. & Lt.	6½s	1952 *k*105½	....	....
Central States Elec.	6s	1945 *k* 92	....	....
Chattanooga Ry. & Lt.	5s	1956 89	81	90
Cincinnati Gas & Elec.	5s	1956 102½	102	103½
Cincinnati Gas & Elec.	5½s	1961 104½	102½	104½
Cities Service	6s	1966 *k* 92	91½	93½
Cities Service	7sB	1966 *k*186	....	....
Cities Service	7sC	1966 *k*129½	125½	131
Cities Service	7sD	1966 *k*103	101½	104
Cities Service	7sE	1966 *k*109	....	....
Cities Service Pwr. & Lt.	6s	1944 *k* 96	93½	96
City L. & T., Sedalia, Mo	5s	1952 84½	83	85½
Cleveland Elec. Illum.	5s	1939 103	102½	103½
Cleveland Elec. Illum.	5s	1954 *k*103	....	....
Cleveland Elec. Illum.	7s	1941 111	110	112
Colorado Pwr.	5s	1953 97½	95½	98
Columbia Gas & Elec.	5s	1927 *k*100½	....	....
Columbia Ry., Gas & El.	5s	1936 93	92½	95
Columbus, Dela. & Marion Elec.	5s	1937 85	83½	86
Columbus, Dela. & Marion Elec.	6s	1937 94	93½	96
Columbus Elec. & Pwr.	6s	1947 *k*102	....	....
Columbus Ry., Pwr. & Lt.	5s	1940 *k* 98	....	....
Columbus Ry. Pwr. & Lt.	6s	1941 *k*104	....	....
Commonwealth Edison	5s	1943 *k*102½	....	....
Commonwealth Edison	5s	1953 101	99½	101
Commonwealth Edison	5s	1954 *k*101	....	....
Commonwealth Pwr.	5s	1939 *k* 92½	....	....
Commonwealth Pwr.	6s	1972 *k* 97½	....	....
Commonwealth Pwr.	6s	1947 *k*104	....	....
Community Pwr. & Lt.	6s	1950 99½	98	99½
Conn. Ry. & Ltg.	4½s	1951 87½	90½	92
Consol. Cities Lt., Pwr. & Trac.	5s	1962 80	80	82½
Consol. Elec.	5s	1955 97½	98	99
Consol. Gas of N. Y.	5½s	1945 *k*105½	....	....
Con. Gas, Elec. Lt. & Pwr. of Balti.	4½s	1935 97½	97½	98½
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	6s	1949 *e*107	105½	107½
Con. Gas, Elec. Lt. & Pwr. of Balti	5s	1965 101½	100	101½
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	5½s	1952 105½	105	106
Con. Gas, Elec. Lt. & Pwr. (notes)	6½s	1951 *m*109½	109	109½
Consumers Elec. L. & P.	5s	1936 *k* 97½	....	....
Consumers Pwr.	5s	1936 *k*101½	....	....
Consumers Pwr.	5s	1952 *k*103½	....	....
Consumers Pwr.	5½s	1954 *k*104½	....	....
Continental Gas & Elec.	5s	1927 *k*100	....	....
Continental Gas & Elec.	6s	1947 *k*101½	....	....
Continental Gas & Elec.	6½s	1964 *k* 99½	....	....
Continental Gas & Elec.	7s	1954 *k*105	....	....
Cumberland Cty. Pw. & Lt.	5s	1942 95½	94	96½
DALLAS PWR. & LT.	6s	1949 104½	104	105
Dayton Ltg.	5s	1937 100	100	101
Dayton Pwr. & Lt.	5s	1941 *k* 101	....	....
Defiance Gas & Elec.	5s	1942 98½	98	99
Denver Gas & Elec.	5s	1949 99	98	100
Denver Gas & Elec. Lt.	5s	1951 *k* 96½	....	....
Des Moines Elec.	5s	1938 101	99	101
Detroit Edison	5s	1933 102½	101	102½
Detroit Edison	5s	1940 102½	100½	102½
Detroit Edison	5s	1949 101½	100	102½
Detroit Edison	5s	1955 101½	100½	101½
Detroit Edison	6s	1932 124½	124½	135
Detroit Edison	6s	1940 108½	106	108½
Detroit Edison	7s	1928 131½	124½	134
Detroit Edison	7s	1929 131	124½	131
Detroit Edison	7s	1930 131	124½	138½
Dominion Pwr. & Trans	5s	1932 97½	95	97
Driver-Harris	8s	1931 97½	95	98½
Dubuque Elec.	6s	1942 106	102	103½
Duke-Price Pwr.	6s	1949 106	105½	106
Duquesne Lt.	6s	1949 106	105½	107
Duquesne Lt.	5½s	1949 106	105	106½
Durham Pub. Serv.	7s	1949 100½	99	101½
EAST PENN. ELEC.	6s	1953 104½	105	106
East Oregon Lt. & Pwr.	6s	1929 100	100	101
East. Tex. Elec.	5s	1942 *k* 97	....	....
Economy Lt. & Pwr.	5s	1956 98½	99	100
Edison Elec. Illum. of Boston (notes)	4½s	1928 99½	99½	100½
Edison Elec. Illum. of Bklyn.	4s	1939 95½	93	99½
Edison El. Illum. (N.Y.)	5s	1995 105½	103	105
El Paso Elec.	5s	1932 *m*102	....	....
El Paso Elec.	5s	1950 96½	95	96½
El. Pwr. Corp. (Germany)	6½s	1950 88½	85½	89½
Elec. Refrigeration	6s	1936 *k*103	100½	107
Elmira Wtr., Lt. & R.R.	5s	1956 97	96	97½
Empire Dist. Elec.	5s	1949 93½	92	93½
Erie Ltg.	5s	1967 99	99	100½
Evansville G. & El. Lt.	5s	1932 99	99	100
FEDERAL LT. & TRAC.	5s	1942 95	92½	97½
Federal Lt. & Trac.	6s	1942 103½	100	104½
Federal Lt. & Trac.	6s	1954 94	93	96
Florida Power & Light	5s	1954 *k* 94	91½	94½
Florida Publ. Service	6s	1955 97	97	99
Florida Public Service	6½s	1949 99	99	103
Ft. Smith Lt. & Trac.	5s	1936 *k* 77	....	....
Ft. Worth Pwr. & Lt.	5s	1931 100½	99	100½
GALVESTON ELEC.	5s	1940 88	89	92
General Elec.	3½s	1942 90	87	89½
Georgia Carolina Pwr.	5s	1952 90	87	91
Ga. Lt., Pwr. & Rys.	5s	1941 88	88	92
Ga. Ry. & Elec.	5s	1932 99½	98½	100½
Ga. Ry. & Elec.	5s	1949 95½	94½	97
Ga. Ry. & Pwr.	5s	1954 98	96	99
Ga. Ry. & Pwr.	6s	1947 *k*104	....	....
Ga. Ry. & Pwr.	7s	1941 *k*105	....	....
German Gen. Elec.	6½s	1940 97½	93½	99½
German Gen. Elec.	7s	1945 97½	95	98½
Great Cons. Elec. Pwr. (Japan)	6½	1950 *k* 85½	85	86
Great Cons. Elec. Pwr. (Japan)	7s	1944 *k* 92½	....	....
Great Falls Pwr.	5s	1940 104	101½	104½
Great Northern Pwr.	5s	1935 99½	98½	100
Great Western Pwr.	5s	1946 *k*100	....	....
Great Western Pwr.	5½s	1955 99½	99	101
Great Western Pwr.	6s	1949 102½	102	103½
Great Western Pwr.	6s	1952 *k*103	....	....
HAMBURG ELEC.	7s	1935 *k* 96½	94	97
Havana Elec. R., Lt. & P.	5s	1954 94½	92½	95
Holtwood Pwr.	6s	1954 104½	100	104½
Houston Ltg. & Pwr.	5s	1931 100	99	101
Houston Ltg. & Pwr.	5s	1953 96½	90½	95½
Houston Ltg. & Pwr.	5½s	1954 100½	99½	102½
Hydraulic Pwr.	5s	1951 101½	101½	102
Hydraulic Pwr.	5s	1950 101½	101½	103
IDAHO PWR.	5s	1947 98	96	98½
Ill. Elec. Pwr.	6s	1943 103	102	103½
Ill. Pwr.	5s	1933 *k* 95½	....	....
Ill. Pwr.	6s	1944 *m* 99	....	....
Ill. Pwr. & Lt.	5½s	1954 98½	97½	99
Ill. Pwr. & Lt.	6s	1953 101½	100½	102½
Ill. Pwr. & Lt.	7s	1953 102½	102	103½
Ind. Elec.	6s	1947 98½	98	100
Ind. Gen. Serv.	5s	1948 98½	96½	98½
Ind. Lighting	4s	1958 83½	82½	84
Indiana & Mich. Elec.	5s	1955 98½	96	98½
Indiana & Mich. Elec.	5s	1957 100	97½	100½
Ind. Pwr.	7½s	1941 *m*105½	*n*104	*n*106
Ind. Service	5s	1950 92½	91½	93
Ind. Service	6s	2020 83½	83	85½
Ingersoll-Rand	5s	1935 100	....	....
International Pwr. Sec.	6½s	1955 *l* 91	....	....
Interstate Elec.	6s	1933 96½	94	98½
Interstate Pwr.	6s	1944 *k* 99	....	....
Interstate Pwr.	7s	1934 *k* 99½	....	....
Interstate Pub. Serv.	6s	1948 99½	98	99½
Iowa Ry. & Lt.	5s	1932 98½	97½	99½
Iowa Southern Utilities	5½s	1950 93	94	96
JERSEY CENT. PWR. & LT.	5½s	1945 96½	95	98
KANSAS CITY PWR. & LT.	5s	1952 *k*102½	....	....
Kansas Elec. Pwr.	6s	1937 *k*101½	....	....
Kansas Elec. Pwr.	6s	1943 101½	99½	102½
Kansas Gas & Elec.	6s	1952 105	101½	105½
Kansas Gas & Elec.	6s	2022 93½	92½	93½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high. Tuesday, April 27. *l*Bid, low, high, Wednesday, April 28. *m*Latest quotations available. *n*1925.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies			Bid Price Saturday April 24	Low 1926	High 1926
BONDS (Continued)					
Kentucky Hydro Elec....	6s	1949	100½	99½	101½
Kentucky Utilities.....	6s	1949	101½	99½	101½
Kings Cty. Elec. L. & P..	5s	1937	102	102	103½
Kings Cty. Elec. L. & P..	6s	1997	125½	120½	123
Kings County Ltg.....	5s	1954	100	98½	100½
Kings County Ltg.....	6½s	1954	109½	106	110
Knoxville Ry. & Lt.....	5s	1946	97½	95½	98
LACLEDE GAS LT.....	5s	1934	101½	100½	101½
Laclede Gas Lt.....	5½s	1953	k103½	....	....
Laurentian Pwr.....	6s	1936	100½	100	101
Laurentide Pwr.....	5s	1946	100	100	102
Lehigh Pwr. Sec.....	6s	2026	k 95	93	95½
Lincoln Gas & Elec.....	5s	1941	94	92½	94½
Long Island Ltg.....	5s	1936	k101½	....	....
Long Island Ltg.....	6s	1954	101½	99½	102
Long Island Ltg.....	6s	1948	107	104½	106
Los Angeles Gas & Elec..	5s	1939	k100	....	....
Los Angeles Gas & Elec..	5½s	1943	101½	99	100½
Los Angeles Gas & Elec..	5½s	1947	k101½	....	....
Los Angeles Gas & Elec..	5½s	1949	101	99	101½
Los Angeles Gas & Elec..	6s	1942	105	102½	105½
Louisiana Pwr.....	6s	1944	99½	98½	100
Louisville Gas & Elec....	5s	1952	k 99½	....	....
Louisville Gas & Elec....	5½s	1954	103	102	103½
Lower Austrian Hydro El.	6½s	1944	85	85	87½
Luzerne Cty. Gas & El...	5s	1948	99½	97½	99
Luzerne Cty. Gas & El...	7s	1944	105	103½	105½
Luzerne Cty. Gas & El...	6s	1954	103½	102	104
MADISON RIV. PWR..	5s	1935	100½	100	101
Manila Elec.....	7s	1942	115	102	115½
Manila Elec. Ry. & Ltg...	5s	1953	91½	89½	94
Manitoba Pwr.....	5½s	1951	96½	94½	97½
Memphis Pwr. & Lt.....	5s	1948	99½	99	100½
Metropolitan Edison.....	6s	1952	107½	104	108
Metropolitan Edison.....	5s	1953	100½	96½	100½
Metropolitan Pwr.....	6s	1953	101½	102½	104½
Michigan Lt.....	5s	1946	k100	....	....
Michigan No. Pwr.....	5s	1941	99½	97	100
Milwaukee El. Ry. & Lt...	5s	1926	m 99½	99½	99½
Milwaukee El. Ry. & Lt...	4½s	1931	97½	97	99
Milwaukee El. Ry. & Lt...	5s	1951	99½	98½	100
Milwaukee El. Ry. & Lt...	5s	1961	k 95½	....	....
Milwaukee El. Ry. & Lt...	6s	1953	101½	100½	104½
Minn. Pwr. & Lt.....	5s	1955	97½	95½	97
Minn. Pwr. & Lt.....	6s	1950	105½	104	106
Miss Power.....	5s	1955	93	92	94
Miss. River Pwr.....	5s	1951	99½	99	100½
Miss River Pwr.....	7s	1935	101½	102	103
Mo. Edison Elec.....	5s	1927	m100½	100½	100½
Mobile Elec.....	5s	1946	k 98	....	....
Monongahela W. Pa. Pub. Service.....	5½s	1953	96	95	97½
Montana Pwr.....	5s	1943	k101½	....	....
Montgomery Lt. & W.P..	5s	1943	m 93	n 86½	n 93½
Montreal Lt., Ht. & Pwr.	4½s	1932	97	97	98½
Montreal Lt., Ht. & Pwr.	5s	1933	99½	99½	101
Montreal Pub. Serv.....	5s	1942	94½	94	95½
Mountain States Pwr.....	6s	1938	100	98½	101
NASHVILLE RY. & LT.	5s	1953	97½	96½	98½
Nashville Ry. & Lt.....	5s	1958	92½	90½	92½
Nassau Lt. & Pwr.....	5s	1927	99½	98½	100½
Nassau & Suffolk Ltg....	5s	1945	91½	89½	92½
National Elec. Power....	6s	1945	92½	92½	94
National Pwr. & Lt.....	7s	1972	k104	....	....
National Pub. Serv.....	6½s	1955	94½	94½	97
Nebraska Pwr.....	5s	1949	100½	99	101½
Nebraska Pwr.....	6s	2022	97½	94½	98
Nevada-Calif. Elec.....	6s	1946	k100	....	....
Nevada-Calif. Elec.....	6s	1950	100½	98½	101
New Brunswick Pwr.....	5s	1937	83½	81½	85
New England Pwr.....	5s	1951	103½	100½	104½
New Jersey Pwr. & Lt....	5s	1936	99	96½	99
New Orleans Pub. Serv...	4½s	1935	89	87	89½
New Orleans Pub.Serv.,B.	5s	1952	k 95½	....	....
New Orleans Pub. Serv...	5s	1955	95	90½	95
New Orleans Pub. Serv...	6s	1949	91	90	92½
N.Y. & Queens El. L.&P..	5s	1930	102½	100½	103½
N.Y. & Westchester Ltg..	4s	2004	80	79½	81½
N.Y. & Westchester Ltg..	5s	1954	98	97½	98½
New York Edison.....	6½s	1941	115½	....	....
New York Edison.....	5s	1944	103½	102	104
N.Y. Gas & El. L., H.&P.	5s	1948	104½	104	105
N.Y. Gas & El. L., H.&P.	4s	1949	k 90	....	....
N.Y. State Gas & Elec...	5½s	1962	101	100	101
Newport News & Hampton Ry., Gas & Elec....	5s	1944	89	89½	91
Niagara Falls Pwr.....	5s	1932	103	100½	103
Niagara Falls Pwr.....	6s	1932	105½	104½	106½
Niagara Falls Pwr.....	6s	1950	106½	105	107
Niagara, Lock. & Ont. Pwr.	5s	1954	m 98½	fn104½	n110
Niagara, Lock. & Ont. Pwr.	5s	1955	k101½	....	....
Niagara, Lock. & Ont. Pwr.	6s	1958	m106	....	....
Norfolk Ry. & Lt.....	5s	1949	95½	94	96½
No. Amer. Edison.....	6s	1952	k104½	....	....
No. Amer. Edison.....	6½s	1948	105½	103½	105
No. Amer. Lt. & Pwr....	7s	1954	99	99	100½
North Caro. Pub. Serv...	5s	1934	k 94	....	....
North Caro. Pub. Serv...	6s	1954	95½	94½	97
North Caro. Pub. Serv...	6½s	1944	99	98	100½
North Shore Elec.....	5s	1940	100½	98½	100½
No. Calif. Pwr.....	5s	1948	100½	99½	101½
No. Ind. Gas & Elec.....	5s	1929	99½	99	100
No. Ind. Gas & Elec.....	6s	1952	104½	102½	105
Northern N. Y. Utilities..	5½s	1949	100½	100	101½
No. Ohio Pwr.....	7s	1935	k 93½	....	....
No. Ohio Trac. & Lt.....	4s	1933	88½	87	89
No. Ohio Trac. & Lt.....	5s	1956	84½	84	86
No. Ohio Trac. & Lt.....	6s	1926	99½	99	100
No. Ohio Trac. & Lt.....	6s	1947	96	92½	96
No. Ontario Lt. & Pwr...	6s	1931	m100	n 95½	n100
No. States Pwr.....	6½s	1933	k112½	108	132
No. States Pwr. (notes)....	6½s	1933	k103½	102½	104
No. States Pwr.....	6s	1948	k103½	....	....
No. States Pwr.....	6s	1941	106	105½	106½
No. States Pwr.....	5s	1941	k100½	....	....
No. Tex. Elec.....	5s	1940	72	72	75
Northwestern Elec.....	6s	1935	102½	102	103½
Northwestern Pub. Serv..	6½s	1948	101½	99½	101½
Nova Scotia Tr. & Pwr...	5s	1946	88	88	90
OHIO PWR.....	5s	1952	95½	94	95½
Ohio Pwr.....	6s	1953	104½	103½	104½
Ohio Pwr.....	6s	2024	97	95½	97½
Ohio Pwr.....	7s	1951	105½	105½	106½
Ohio Pub. Serv.....	5s	1954	95½	92½	94½
Ohio Pub-Serv.....	6s	1953	101½	101	102½
Ohio Pub. Serv.....	7½s	1946	113½	112½	113½
Ohio Pub. Serv.....	7s	1947	112	110½	112
Ohio River Edison.....	6s	1948	103½	101½	104½
Okla. Gas & Elec.....	5s	1950	94½	93	94½
Okla. Gas & Elec.....	6s	1940	k 96½	....	....
Ontario Pwr. of Niagara Falls.....	5s	1943	k101	....	....
Ontario Transmission.....	5s	1945	99½	99½	99½
Ozark Pwr. & Wtr.....	5s	1952	80½	77	81½
PACIFIC COAST PWR..	5s	1940	99½	99	100½
Pacific Gas & Elec.....	5s	1942	100	97½	100½
Pacific Gas & Elec.....	5s	1955	m 93½	n 94	n 95½
Pacific Gas & Elec.....	5½s	1952	k104	....	....
Pacific Gas & Elec.....	6s	1941	k107½	....	....
Pacific Lt. & Pwr.....	5s	1942	k101½	....	....
Pacific Lt. & Pwr.....	5s	1951	100½	100	101½
Pacific Pwr. & Lt.....	5s	1930	k100	....	....
Pacific Pwr. & Lt.....	5s	1953	m 96½	....	....
Part Shoals Pwr.....	5s	1952	97	95	98½
Paterson & Passaic G.&E.	5s	1949	103	100	101½
Penn Central Lt. & Pwr...	6s	1953	103½	102½	105
Penn Edison.....	5s	1946	98½	96½	98½
Penn. Elec.....	6s	1955	m105	92	105
Penn Elec.....	6½s	1954	m105	97	100½
Penn.-Ohio Edison.....	6s	1950	99½	98	106
Penn Ohio Elec.....	6½s	1938	107	105	107
Penn Ohio Pwr. & Lt.....	5½s	1954	k 99½	....	....
Penn Ohio Pwr. & Lt.....	6s	1939	98	97	98½
Penn Pwr. & Lt.....	5s	1952	99½	97½	99½
Penn Pwr. & Lt.....	5s	1953	k 99½	97½	99½
Penn Pwr. & Lt.....	6s	1953	105½	105	106
Penn Pwr. & Lt.....	7s	1951	106	105½	106½
Penn Pub. Serv.....	5s	1954	97½	96	98½
Penn Pub. Serv.....	6s	1947	104½	103	105
Penn Wtr. & Pwr.....	5s	1940	101½	101½	102½
Penn Wtr. & Pwr.....	5½s	1953	103½	102½	103½
Phila. Co.....	6s	1944	k105½	....	....
Phila. Co.....	5½s	1938	k101½	....	....
Phila. Co.....	5s	1951	98	97½	99½
Phila. Co.....	5s	1949	m104½	103½	104½
Phila. Elec.....	5s	1966	c103½	102	104½
Phila. Elec.....	4s	1966	c 85	84	87
Phila. Elec.....	5s	1960	c103½	102	103½
Phila. Elec.....	6s	1941	c107½	107½	108½
Phila. Elec.....	5½s	1947	c107½	103½	107½
Phila. Elec.....	5½s	1953	c107½	103½	107½
Phila. Elec. Pwr.....	5½s	1972	k102½	100½	102½
Portland Elec. Pwr.....	6s	1947	101½	99	101½
Portland Gen. Elec.....	5s	1935	102½	99½	101½
Portland Ry., Lt. & Pwr..	5s	1942	92½	88½	93
Portland Ry., Lt. & Pwr..	6s	1947	100½	....	....
Portland Ry., Lt. & Pwr..	7½s	1946	107½	106½	108½
Potomac Edison.....	6s	1949	100	99	100½
Potomac Edison.....	6½s	1948	103½	103	104
Potomac Elec. Pwr.....	5s	1929	j100½	....	....
Potomac Elec. Pwr.....	5s	1936	j100½	....	....
Potomac Elec. Pwr.....	6s	1953	j106½	....	....
Potomac Elec. Pwr.....	7s	1941	j107½	....	....
Power Corp. of N. Y.....	6s	1942	100½	101	101½
Power Corp. of N. Y.....	6½s	1942	104½	104	105½
Power Securities.....	6s	1949	k 76	....	....
Pub. Lt. & Pwr.....	5s	1945	68	68	73
Pub. Serv. Co. of Colo....	5½s	1954	95	95	96½
Pub. Serv. Co. of Colo....	6s	1953	100½	100	101½
Pub. Serv. Co. of Colo....	7s	1933	100½	101½	102½
Pub. Serv. Corp. of N.J..	5s	1959	m101	104½	105
Pub. Serv. Corp. of N.J..	6s	1944	k103½	....	....
Pub. Serv. Co. of No. Ill..	5s	1956	98	98	99½
Pub. Serv. Co. of No. Ill..	5½s	1962	103	103½	105
Pub. Serv. Co. of No. Ill..	5½s	1964	103	103½	105½
Pub. Serv. Co. of Okla....	6s	1949	101½	98½	102
Pub. Serv. Elec. & Gas...	5½s	1959	k104½	....	....
Pub. Serv. Elec. & Gas...	5½s	1964	k104½	....	....
Pub. Util. Evansville, (Ind.)	6s	1929	k100	....	....
Puget Sound Pwr.....	5s	1933	100½	99	101½
Puget Sound Pwr. & Lt...	5½s	1949	k101	....	....
QUEBEC PWR.....	6s	1953	103½	101½	103½
Queensborough Gas & E..	5s	1952	100	99½	100½
Queensborough Gas & E..	6s	1953	105	104	105½
RHINE-WESTPHALIA ELECTRIC PWR....	7s	1950	k 96	93½	96
Rio de Janeiro Tram., Lt. & Pwr.....	5s	1935	94	93	94½
Robbins & Myers.....	7s	1952	63	58	68½
Rochester Gas & Elec.....	5½s	1948	105½	105½	106
Rochester Gas & Elec.....	7s	1946	112½	112½	114
Rochester Ry. & Lt.....	5s	1954	100½	100½	101½
Rockford Elec.....	5s	1939	100½	99½	100½
ST. MAURICE PWR...	6½s	1953	108	108	109½
St. Paul Gas Lt.....	5s	1944	100½	100½	101½
St. Paul Gas Lt.....	5½s	1954	101½	101	102½
St. Joseph Ry., Lt., H.&P.	5s	1937	94½	94½	97
Salt River Valley Wtr....	6s	1938	k100	....	....
Salmon River Pwr.....	5s	1952	100½	100½	101½
San Antonio Gas & Elec..	5s	1949	96½	96	97½
San Antonio Pub. Serv....	6s	1952	102½	101½	103½
San Diego Cons. G.& E....	5s	1939	k100	....	....
San Diego Cons.G.&E....	6s	1939	102½	101	102½
San Joaquin Lt. & Pwr...	5s	1945	100	98½	100
San Joaquin Lt. & Pwr...	6s	1950	103½	103	104½
San Joaquin Lt. & Pwr...	6s	1952	103½	99½	103½
San Joaquin Lt. & Pwr...	6s	1954	103	100½	102½
Sauda Falls.....	5s	1955	96	94	96
Savannah Elec. & Pwr....	7½s	1941	k101½	....	....
Saxon Pub. Wks. (Germany).....	7s	1945	k 96	....	....
Scranton Electric.....	5s	1937	101½	101½	102½
Seattle Elec.....	5s	1930	101	100½	101½
Seattle Elec.....	5s	1929	99½	99½	100½
Seattle Elec.....	5s	1939	92½	92½	94½
Seattle Ltg.....	5s	1949	92	90½	94
Shawinigan Wtr. & Pwr..	5s	1934	100½	100	101½
Shawinigan Wtr. & Pwr..	5½s	1950	104	103½	104½
Shawinigan Wtr. & Pwr..	6s	1950	104½	104½	105½
Sheboygan Elec.....	5s	1946	95½	94	96½
Siemens & Halske.....	7s	1928	k 99½	96	100
Siemens & Halske.....	7s	1935	k 97½	93	98
Sierra & San Fran. Pwr...	5s	1949	k 94½	....	94½
Sierra & San Fran. Pwr....	6s	1949	k 89	....	....
Sioux City Gas & Elec....	6s	1947	102½	101½	102½
Sioux City Gas & Elec....	6s	1949	102½	102	105
So. Caro. Gas & Elec.....	6s	1942	93	78	97
So. Caro. Gas & Elec.....	6s	1932	78	70	82
Southeast Pwr. & Lt. (ex-warranto).....	6s	2025	k 94½	89	94½
So. Cal. Edison.....	5s	1939	k100½	....	....
So. Cal. Edison.....	5s	1944	99	98	99½
So. Cal. Edison.....	5½s	1944	104½	103	105
So. Cal. Edison.....	6s	1943	103½	102	104
So. Cal. Edison.....	6s	1944	k105	....	....
So. Cities Utilities.....	8s	1931	99	99	102
Southern Colo. Power....	6s	1947	98½	97½	99½
So. Ind. Gas & Elec.....	6s	1947	k 98½	....	....
Southern Pwr.....	5s	1930	100½	100	101
So. Public Utilities.....	5s	1943	100½	100	101½
So. Sierras Pwr.....	6s	1936	k103½	....	....
So. Utilities.....	6s	1933	m102	n 97½	n102½
So. Wisconsin Pwr.....	5s	1938	92½	91	93
Southwestern Gas & E....	5s	1932	97	97	98½
Southwestern Gas & E....	6s	1957	97½	97½	99½
Southwestern Lt. & Pwr..	6s	1937	98	98	99½
Southwestern Power.....	6s	1944	96½	96½	98
Southwestern Pwr. & Lt..	5s	1943	96½	94	96½
Southwestern Pwr. & Lt..	6s	2022	94½	94	96
Southwestern Pub. Serv..	6s	1945	93½	94	96
Southwestern Utilities....	8s	1936	97	92½	96
Springfield Ry. & Lt.....	5s	1926	99½	99½	100½
Standard Elec. of Cal....	5s	1939	100	99½	101
Standard Gas & Elec.....	6s	1935	k 99½	....	....
Staten Island Edison.....	6½s	1953	105½	106	107½
Superior Water, Lt. & Pwr.	4s	1931	94½	94½	95½
Syracuse Ltg.....	5s	1951	101	100	101
Syracuse Ltg.....	5½s	1954	104	103½	104½
TAMPA ELEC.....	5s	1933	k 99	....	....
Tenn. Elec. Pwr.....	6s	1947	k105½	....	....
Tenn. Pwr.....	5s	1962	96½	96	97
Tex. Pwr. & Lt.....	5s	1937	99	98½	100
Tex. Pwr. & Lt.....	6s	2022	97½	95½	97
Tide Water Pwr.....	6s	1942	101½	100	101½
Tide Water Pwr.....	7s	1937	104	100	107
Toho Elec. Pwr. (Japan)..	7s	1955	k 92½	....	....
Tokyo Elec. (Japan).....	6s	1928	k 98½	....	....
Toledo Edison.....	5s	1947	100½	100	100½
Toledo Edison.....	7s	1941	k100½	....	....
Toledo Gas, Elec. & Htg	5s	1935	100½	98	100½
Toledo Tr., L.&P. (notes)	5½s	1930	98½	98	99½
Topeka Edison.....	5s	1930	99	99	100
Topeka Ry. & Lt.....	5s	1933	94½	94½	96½
Trenton Gas & Elec.....	5s	1949	102½	100½	102½
Tri-City Ry. & Lt.....	5s	1930	k 98	....	....
Twin State Gas & Elec...	5s	1953	96	95	96½
Twin State Gas & Elec...	5½s	1945	98½	98	99
Tyrol Hydro-Elec. Pwr...	7½s	1955	96½	95½	97½
UJIGAWA ELEC PWR.	7s	1945	91½	92	94
Union Elec. Lt. & Pwr...	5s	1932	101	100½	102½
Union Elec. Lt. & Pwr...	5s	1933	100½	100½	101½
Union Elec. Lt. & Pwr...	5s	1954	99½	99½	101
Union Elec. Lt. & Pwr...	5½s	1954	102½	102½	102½
United Elec. of N.J.....	4s	1949	88	87½	89
United Elec. Lt. & Pwr...	4½s	1929	98	98	99½
United Gas & Elec.....	6s	1945	m101½	n 96	n101
United Lt. & Pwr. (notes)	5½s	1928	99½	99	100½
United Lt. & Pwr.....	5½s	1959	96	96	97½
United Lt. & Pwr.....	6½s	1974	96½	95½	98½
United Lt. & Rys.....	5s	1932	96½	96	97½
United Lt. & Rys.....	6s	1926	99½	100	101½
United Lt. & Rys.....	6s	1952	100½	99	101½
United Lt. & Rys.....	6s	1973	90	89½	92
United Pwr. & Lt.....	6s	1944	102	102	103½
United Water, G. & E....	5s	1941	95	94	95
Utah Lt. & Trac.....	5s	1944	k 89½	....	....
Utah Pwr. & Lt.....	5s	1944	k 96½	....	....
Utah Pwr. & Lt.....	6s	1944	103	102½	104½
Utah Pwr. & Lt.....	6s	2022	93½	88½	94½
Utica Elec. Lt. & Pwr....	5s	1950	102½	100½	102½
Utica Gas & Elec.....	5s	1957	102½	100½	102½
Utica Gas & Elec.....	6½s	1949	104½	103½	104½
VERMONT HYDRO - ELEC..	6s	1929	100	100	101
Vicksburg Lt. & Trac....	5s	1932	94	93½	93½
Virginian Pwr.....	5s	1942	98	88	99
Virginian Pwr.....	6½s	1954	m103½	103	104½
Virginia Ry. & Pwr.....	5s	1943	99	97½	99
Virginia-Western Pwr....	6s	1953	105	101½	106½
WAGNER EL. MFG...	7s	....	b100½	100½	101½
Washington Coast Util...	6s	1941	102½	102½	103½
Washington Ry. & Elec...	4s	1951	f 81½	....	....
Washington Ry. & Elec...	6s	1933	f103½	....	....
Washington Wtr. Pwr....	5s	1939	102½	101½	102½
West Penn Pwr.....	5s	1963	k101½	....	....
West Penn Pwr.....	5s	1946	k101½	....	....
West Penn Pwr.....	5½s	1953	105½	104½	106
West Penn Pwr.....	7s	1946	106½	105½	108½
W. Va. Lt., Ht. & Pwr....	6s	1929	101½	101	102½
West Virginia Utilities....	6s	1935	97½	95½	97½
W. Va. Water & Elec.....	6½s	1942	m103½	102½	104
Westchester Ltg.....	5s	1950	103	102½	103½
Western Elec.....	5s	1944	k102½	....	....
Western N. Y. Utilities...	5s	1946	97	96½	98
Western Pwr.....	6½s	1954	100½	100	102
Western Pub. Service....	6s	1950	98	98	99½
West States Gas & Elec...	5s	1941	100	98½	99½
West States G.&E. (notes)	6s	1937	94½	94½	96
West States Gas & Elec...	6s	1947	k104	....	....
West United Gas & El....	5s	1950	102	101½	102½
West United Gas & El....	6s	1950	m102	n100	n102
Westphalia Un. Elec. Pwr	6½s	1950	m 98½	....	....
Westinghouse El. & Mfg.	7s	1931	k105½	....	....
Wheeling Elec.....	5s	1941	99	99	100
Wichita R. R. & Lt.....	5s	1932	85½	83	88
Winnipeg Elec.....	6s	1954	96	96	97½
Wisconsin Elec. Pwr.....	5s	1954	99½	98½	100
Wisconsin Gas & Elec....	5s	1952	k 99½	....	....
Wis.-Minn. Lt. & Pwr....	5s	1944	k 97½	....	....
Wisconsin Pwr., Lt. & Ht	5s	1946	93½	92	94½
Wisconsin Pub. Service...	6s	1952	101½	101	102½
Wis. Ry., Lt. & Pwr.....	5s	1933	95½	94½	96½
Wis. River Pwr.....	5s	1941	93½	92½	94
Wolverine Pwr.....	7s	1943	101½	100	101½
YADKIN RIVER PR..	5s	1941	k100½	....	....
Yarmouth Lt. & Pwr.....	5s	1937	83	83	87
Yarmouth Lt & Pwr.....	8s	1951	102	99	102

Stock Exchange: cChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Tuesday, April 27. lBid, low, high, Wednesday, April 28. mLatest quotations available. n1925.

Manufacturing and Markets

France Buys Large Amount of American Fiber

Proposed Tariff Revision Increasing Duty on American Products May Affect Our Exports

THE United States is the most important source of the French supply of vulcanized fiber, according to a survey of that market recently completed. At first fiber was mainly employed for insulation purposes, to a much less degree in mechanical appliances and as a leather substitute in the making of handbags and small trunks. Its mechanical uses have multiplied to such an extent that it is estimated that 80 per cent of the French consumption is used for such purposes, only 20 per cent being used for electrical insulation. This change has come about in addition to an intensified use of the product in the transmission of low-voltage and medium-voltage electric current.

Shipments Increasing

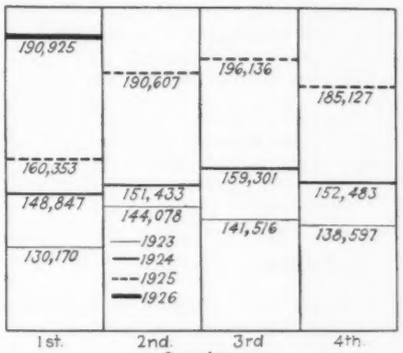
Shipments made in 1924 from the United States, which supplies the major portion of the fiber consumed annually in France, totaled 745,540 lb. in the form of sheets, strips, rods and tubes and 27,211 lb. in manufactured shapes. In 1925 exports of sheets, strips, rods and tubes amounted to 970,658 lb., but shipments of manufactured shapes decreased to 4,690 lb. Germany, England, Italy and Sweden follow next in order as exporters of fiber to France. Germany is our most serious competitor in fiber up to ¾ in. in thickness. Sheets of ⅜ in. and less are considered as equal to American fiber, but for material between that size and 3 in. the product of American factories has no rival. It is stated that in 1914 only one small fiber factory existed in Germany, but that under war-time pressure production was increased and now three large plants supply home needs and compete actively in other European markets. The American fiber actually sets the standard, and its well known serviceability gives it the preference where the price margin, as at present, is narrow.

A proposed tariff reclassification measure which has been introduced in the French Parliament calls for an increase in the general duty applicable to American fiber. Action on this tariff revision may be taken in the next few months. It is not definitely known what influences are behind the movement to raise the tariff against foreign vulcanized fiber, particularly that from the United States. Recently a prospectus was issued concerning the formation of a new French company for the manufacture of the material, and protection for this and the small factory already in existence, as well as others that may come into being, may have been a factor in the proposed increases.

In any event, if the duties proposed are given the effect of law, the burden will fall most heavily upon the American product. The resulting price difference will greatly lessen, if not destroy, the American participation in trade of the grades of fiber produced satisfactorily in England, Sweden, Germany and Italy.

Washing-Machine Sales Show Large Increase

Sales of electric washing machines have shown a steady increase during the last three years. For 1925 the increase is particularly noticeable, as shown in the accompanying cut. The



SALES OF ELECTRIC WASHING MACHINES BY QUARTERS, 1923-1925

units sold during the first quarter of 1926 show a much greater proportionate increase over sales in the same quarter last year than in the past three years. The number of the various types of washing machines sold during the first quarter of 1926 is as follows: Hand-power, 26,854; gas and power, 13,742; water-power, 7,228; electric, 190,925; total, 238,749.

Marked Increase in Business Activity Is Anticipated

Prominent Banker's Private Opinion of the Trend in Business and Industrial Activity

INCREASED industrial and business activity that may overshadow anything experienced in the past six years is foreseen by a nationally known banker and business analyst who is noted for the accuracy of his forecasts. The trend in business conditions which has been changing since the stock market slump in early March offers three possible courses—serious depression, continued moderate industrial activity accompanied by minor recessions and recoveries, or a short slump and then a marked increase in general business and industrial operations. This banker is strongly inclined to view the latter and more optimistic possibility as the most probable.

Conditions in the financial markets and in industry must pass through a further moderate readjustment before a definite but strong upward trend in the nation's business activities will be resumed. While this will not be long delayed, such a readjustment appears vitally necessary to the welfare of business.

Basic Conditions Sound

During the first quarter of 1926 record figures were reported for the output of steel, car loading, the automobile industry, building construction and bank clearings. These increases have been in the making for the last two years, and the continued new records made by such important indicators must at some time come down. That point has been reached and the adjustment process has been at work. There will be some business recession but no collapse.

The stock market, as viewed about the middle of the past month, was, in the banker's opinion, no doubt due for still further readjustments. This may last in a moderate fashion into the summer months, but before the hot weather is over, perhaps by the last of July, a resumption of the so-called bull market may be expected. How far this will anticipate an exceptional industrial activity which is bound to follow cannot be exactly foretold, but the time lag will probably be comparatively short.

Sales of Washing Machines by Quarters 1923-1925 (Except Electrics)

Electric Washing Machine Sales Shown Separately
(Data Supplied by American Washing Machine Manufacturers' Association)

Quarter	Hand-Power Machines			Gas and Power Machines			Water-Power Machines			Total Including Electric Machines		
	1923	1924	1925	1923	1924	1925	1923	1924	1925	1923	1924	1925
First.....	35,317	22,079	25,174	5,934	3,803	6,762	7,352	4,732	5,475	179,058	179,461	197,764
Second.....	30,811	20,470	25,314	6,319	4,310	9,034	7,758	4,023	5,844	188,176	180,227	230,799
Third.....	30,212	19,036	22,348	4,289	3,987	10,431	6,947	5,078	5,665	172,964	187,402	234,580
Fourth.....	19,063	20,748	20,922	3,568	4,842	9,518	6,498	3,729	3,789	167,726	181,802	219,356
Total.....	105,403	82,333	93,758	20,110	16,933	35,745	28,555	17,562	20,773	707,924	728,892	882,499

Basic conditions in the United States are altogether too good—too sound—to admit of any extended depression. There is an enormous amount of money available in the country, credit is good, wholesale prices are declining, and there is a better relation between farm prices and industrial prices. Other countries have been producing at prices which enable them to jump our present tariff wall. American industry is getting its prices in line with world markets, which is essential to continued international commercial activity. With all of these conditions, credit, money available at low interest rates and a vast industrial machine already operative, the business outlook is most encouraging.

INDUSTRY MAY ABSORB MORE CREDIT

Excessive speculation in land and securities prevented inflation of commodity prices last year. There does not seem to be any other Florida on the speculative horizon, however, to absorb credit during the next upward swing, and it looks as if the available credit will be divided between the stock market and industry, with industry absorbing more than it has for years.

Though at present the trend is slightly downward, the future or the long pull over a period of two or three years may be reviewed with the utmost confidence. The coming period of industrial activity carries with it, however, one potential danger, the banker quoted thinks—the possibility of inflation and recurrence of excessive inventories as in 1920. However, with that experience still vividly in mind, industry should be able so to govern its production in accordance with actual market conditions as to prevent pyramiding of orders and overproduction, with their disastrous consequences. In all of this general business and industrial activity which is anticipated the entire electrical industry must naturally participate and benefit.

Sign Manufacturers Need to Develop Markets

In determining why the electric sign business is not progressing as fast as it should the Society for Electrical Development, as the outcome of discussion with some of its members engaged in the electric sign business, has found that most of the problems seem to be common to them all. Among the detriments are too narrow margins, lack of central-station co-operation, unintelligent competition, and sharp sales practices, but one great factor seems to stand out—lack of understanding on the part of the electrical trade and the public of what electric signs are for. The society as a result of these discussions believes that it will be helpful to the business to stop selling signs as such, but rather to sell electrical advertising as a business builder for the store, office, factory, etc. The society advises co-operative market development with the advantages of electrical advertising as a basic force in attracting trade.

Business Conditions

SOME recession in business is noted in some sections of the country, but this is only considered temporary as inquiries are numerous. Reports from other sections indicate that equipment is in good demand. Manufacturers are quite optimistic as to the outlook and to fortify their assertions point to the attitude of buying only for immediate requirements and to the fact that no projects have been abandoned nor are there any indications that they will be. Wire manufacturers state that the number of orders booked will keep factory production schedules at a high rate for the next three months, and, moreover, inquiries indicate good business for the rest of the year. Steel bookings during April are not expected to fall off as much as is usual at this period.

In New England current sales, with the possible exception of sales of small motors, have decreased. Cautious buying is noted, but no projects have apparently been abandoned and favorable trade trends are predicted through the year. Central-station sales are steady and industrial electric heating is attracting interest. A slight recession in sales is noted in the New York district, but several orders are expected to be placed by central-station companies in the next week or two. In the Southeast merchandise campaigns on refrigerators and ranges have been productive, sales of distribution material are active and the industrial demand is good. In the St. Louis territory large equipment is in demand and sales are reported as being about 10 per cent higher for the year to date as compared with last year. The volume of business in the Middle West is satisfactory and greater activity is anticipated. On the Pacific Coast active buying is noted in all lines. Several inquiries have been received from industrial plants, and central-station companies are expected to place many orders in the very near future.

Non-Ferrous Metal Market Dull--Lead in Most Active Demand

The uncertainty attending the settlement of the British coal-mine labor difficulties has been a strong factor in the metal markets, not only abroad but in this country also. Buyers here are disinclined to commit themselves until they see what happens in London. If a satisfactory adjustment is reached, good buying both abroad and in the domestic market is confidently expected. Had it not been for several million pounds of copper sold for Middle West delivery the business for the week would have been extremely small.

Though lead has fluctuated up and then down in London during the last week, no change has been made in the contract price of the American Smelting & Refining Company, which continues at 7.85 cents, New York. Wednesday's London prices are slightly higher than a week ago and the domestic market is distinctly stronger. A modest business in zinc has been transacted, most of it at 6.90 cents (St. Louis), though 6.95 cents was obtained last week Thursday. On Wednesday

NEW YORK METAL MARKET PRICES

	April 21, 1926 Cents per Pound	April 28, 1926 Cents per Pound
Copper, electrolytic	13.85	13.925
Lead, Am. S. & R. price	7.85	7.85
Antimony	17½	17
Nickel, ingot	35	35
Zinc, spot	7.30	7.15-7.20
Tin, Straits	62.875	63
Aluminum, 99 per cent	28	28

Base copper price April 28, 1926, 16½ cents

Delinquent Electrical Accounts

(Data Supplied by National Electrical Credit Association)

NUMBER OF ACCOUNTS REPORTED

Division	March 1925	March 1926	Per Cent Increase or Decrease	Three Months Jan.-Feb.-March 1925	Three Months Jan.-Feb.-March 1926	Per Cent Increase or Decrease
New York	462	460	— .4	1,104	1,092	— 1.0
Middle and Southern Atlantic States	220	229	+ 4.1	639	566	—11.4
New England	77	103	+33.7	202	277	+37.1
Pacific Coast	12	22	+83.3	52	77	+48.0
Central	1,035	1,083	+ 4.6	2,601	2,776	+ 6.7
Total	1,806	1,897	+ 5.0	4,598	4,788	+ 4.1

TOTAL AMOUNTS REPORTED

Division	March 1925	March 1926	Per Cent Increase or Decrease	Three Months Jan.-Feb.-March 1925	Three Months Jan.-Feb.-March 1926	Per Cent Increase or Decrease
New York	$69,232	$71,157	+ 2.8	$190,451	$161,066	—15.4
Middle and Southern Atlantic States	29,438	19,281	—34.5	101,749	52,088	—48.8
New England	7,516	6,847	— 8.9	21,694	26,579	+22.5
Pacific Coast	1,868	3,355	+79.5	10,882	11,881	+ 9.1
Central	123,857	122,128	— 1.4	329,010	267,710	—18.6
Total	$231,911	$222,768	— 3.9	$653,786	$519,324	—20.5

AVERAGE AMOUNTS

Division	March 1925	March 1926	Jan.-Feb.-March 1925	Jan.-Feb.-March 1926
New York	$150	$155	$172	$147
Middle and Southern Atlantic States	133	84	159	92
New England	97	66	107	95
Pacific Coast	155	152	209	154
Central	119	112	126	96

6.80 cents seemed to be the top of the market with little business in sight. The tin market has been quiet most of the week, though some tinplaters were in the market. Practically no spot tin, Straits, is obtainable, and premiums of about 1 cent above May tin are asked for such as is on the market.

Good Business in Middle West—Greater Activity Anticipated

The volume of business in the Middle West is satisfactory and greater activity is anticipated. Greater industrial activity is being planned by manufacturers in this territory. The various utility companies are busy, and although construction work has been going on steadily, the spring extension work is just under way. A prominent utility company has requested its sources of supply for cables to increase production 30 per cent over the anticipated demand per month. Considerable quantities of apparatus are being purchased, with a pulverized-fuel boiler valued at $325,000, a battery of circulating-water pumps amounting to $40,000 and spare turbine parts in excess of $50,000 as the outstanding items. Jobbers' sales are considered good, and appliances are in demand, particularly washing machines. Motor sales continue good.

Slight Recession Noted in the New York District

Sales to central-station companies in the New York district showed a decrease in almost all lines. Transformer sales, which were very active during the previous week were slow and fewer inquiries were received. Some of the local companies, however, are planning additions to their equipment which are expected to result in a fair quantity of transformer orders within the next week or so. Manufacturers of pole-line hardware, switching equipment, etc., also report a decrease in sales, with indications that this situation may continue for several weeks. Poles and cross-arms, however, are still in demand with a steady volume of orders from various sources. The demand for motors and control apparatus in the industrial field is slowing up, and, although in some instances a fair volume of sales is reported, total orders have been less than last month but are better than for the same period last year. Jobbers continue to report a dull market.

Large Equipment in Demand in the St. Louis District

For the four months of 1926 average business in the St. Louis district is reported as being about 10 per cent above the same period last year. Jobbers report a slight depression in the lighter equipment for the past four weeks, with many inquiries, but some hesitation in the placing of orders. This seems to be somewhat seasonal as the same condition existed in April last year. However, what is lost in sales of the smaller equipment is made up in the demand for large units. One of the steam railroads is in the market for a 1,500-kw. turbine and a large motor-driven air compressor, and a large central-station company is placing an order for another 50,000-kw. turbine with auxiliaries. One of the steel companies is electrifying its mill and installing a motor-driven continuous strip mill, and another is buying a large air compressor and synchronous motor.

In the last eight weeks there has been great activity in the lead belt of southeast Missouri. One of the companies in its program of expansion is installing a 4,000-kw. turbine, a large motor-driven air compressor and a 150-hp. ventilating fan. Another company, at St. Francis, Mo., is buying new boilers and changing to electric drive throughout. A large electric manufacturer also reports great activity in the sale of motors, transformers and fans throughout the territory.

Sales in New England Decrease—Outlook Predicted Favorable

Orders placed in the New England district were appreciably smaller than for several weeks, with the possible exception of small motors. This commodity continues to be in steady demand and one manufacturer reports frequent inquiries for larger sizes. Purchases comprise many small orders, the tendency being to spread buying over a period of several weeks rather than to cover requirements in one order. Central-station sales are steady, though few outstanding orders were received. On the other hand, many inquiries have been placed and a number of interesting projects are likely to mature shortly. Switch and control apparatus will soon be purchased for a number of substation extensions, and several orders have already been placed for Maine development.

Industrial electric heating is attracting interest, and one manufacturer reports several negotiations under way for melting pots for Middle Western locations. Electric welding sales have increased, and electric battery sales are encouraging. New construction projects are being reflected favorably in an increasing demand for wire, hardware and fixtures. Household appliance sales are maintaining an even trend, with ranges and refrigerators attracting most interest among the major appliances. A prominent manufacturer's representative, in summing up the conditions in trade in New England, while admitting that this district had not as yet hit its stride in buying, on the other hand, predicts it is sure to live up to earlier forecasts that the coming year promises to return favorable trade trends. This opinion is based on the fact that no projects have been abandoned, that intensive selling campaigns are being planned and, finally, that this district, industrially, is gradually getting back to a sound footing.

Active Buying in All Lines on the Pacific Coast

Business is very good on the Pacific Coast in all branches, improvement in dealers' and contractors' business being especially gratifying. The carpenters' strike, which caused some apprehension, has not seriously interferred with business. Sales of rubber-covered wire are excellent. One order which will soon be placed calls for 200,000 ft. for use in a San Francisco building. Good stock orders for wiring supplies are also reported from various sections. A vigorous campaign for "red seal" homes will soon be under way, and dealers' business after a dormant spring is showing improvement. The demand for fans has been very good, owing to hot weather, but sales have been handicapped by the non-arrival of the bulk of jobbers' stocks. Power-company purchases have included much line-construction material, and industrial business is excellent. An order from an Oakland factory covers $7,000 worth of electric welding material.

Sales of motors and heavy apparatus in the Puget Sound district were light as compared with other weeks of the month, but inquiries were comparatively numerous. Requests for bids were received from lumber and shingle mills and other industrial sources. The largest inquiry was from a timber company in Idaho and called for $100,000 worth of electrical equipment. A paper and board mill in Washington has recently increased its capital stock and will purchase additional machinery and electrical equipment. Orders will be placed soon by the city of Seattle for wire, poles, cross-arms, etc., for use in extending its distribution system. About $40,000 worth of automatic feeder-circuit breakers and oil switches will be included in that company's purchase. The Puget Sound Power & Light Company also plans the immediate extension of transmission lines to rural communities in Kitsap and Pierce Counties.

Merchandise Campaigns Active in the Southeast

Merchandise campaigns by central-station companies in the Southeast are meeting with splendid success. One of the larger power companies has within the past three weeks sold approximately 100 domestic electric refrigerating machines, and the campaign has yet a week to run. Range campaigns for the larger power companies are getting under way, and prospects are for excellent results, particularly as one manufacturer has brought out a popular-priced range which bids fair to be a big seller. The acquisition of small distribution systems by the larger power companies in this section is progressing satisfactorily and is causing a brisk demand for distribution material, one jobber reporting the receipt last week of one order from a power company for $20,000 worth of poles and pole-line hardware. House wiring is also reasonably active. Fans are already beginning to move in the southern part of the territory, with sales the best on record to date.

Considerable activity is to be noted in the textile field, although the textile situation generally is somewhat spotty. Additions to mills and revamping of old mills in sections of Georgia are taking a considerable amount of construction materials, and one manufacturer reports the receipt last week of an order from a South Carolina mill for 1,500 fractional-horsepower motors for individual drive. A new textile mill to cost approximately $3,000,000 is also planned for early construction.

Activities of the Trade

Fourth Home-Lighting Course at Edison Lighting Institute

The Edison Lamp Works of the General Electric Company announces the fourth home-lighting course to be held at the Edison Lighting Institute from June 7-11. The course is designed primarily to train women employees of electric service companies in the best methods of selling residence lighting. Subjects to be covered in the course will include fundamental facts about electricity and their application to appliances and to illumination in the home, modern methods employed in house wiring, a historical review of the incandescent lamp, discussion of the advantages of the new standard line of "Mazda" lamps, demonstrations of different systems of illumination, including both utility and decorative lighting; study of different types of lighting equipment and their use in the home, and discussions on salesmanship and advertising.

Demonstrations will be given in the model five-room apartment of the institute. A trip will be made to New York City to inspect various classes of lighting equipment in the several cost ranges, so that those attending the course will have an opportunity of seeing the modern tendencies in fixture design. Students should be registered for the course at the earliest possible time. Hotel reservations will be made on request for any one planning to attend the course.

Graybar Electric Announces Reorganization Changes

A reorganization of the sales department of the Graybar Electric Company, involving the reallocation of the managing personnel and the creation of several new activities, to take effect immediately, has been announced by G. E. Cullinan, vice-president in charge of sales. The reorganization, together with the staff designation of the personnel, is as follows: M. A. Curran, assistant to the vice-president, formerly manager of the central-station department; J. L. Ray, general supply sales manager, formerly manager of the supply and equipment department; E. A. Hawkins, general telephone and appliance sales manager; G. F. Hessler, general utilities sales manager, formerly manager of the line material sales department; G. K. Heyer, assistant general supply sales manager, formerly telephone sales manager; A. J. Eaves, public address and carrier current sales manager; P. M. Rainey, telephone sales manager, formerly sales development manager; G. E. Chase, broadcasting sales manager, formerly broadcasting sales engineer; O. E. Richardson, broadcasting sales engineer; J. W. Skinkle, signaling sales manager; A. E. Hetzner, signaling sales engineer; and A. S. Wise, appliance sales engineer. These changes in staff personnel are the culmination of a reorganization of the Graybar general sales organization which has been in course of development for some time. Its effect, according to Mr. Cullinan, will be to present a more specialized organization, necessitated by the great growth of the electrical industry as a whole, and more particularly by the expanding activities of the company.

Western Electric Sales for First Quarter Show Increase

Sales billed by the Western Electric Company, Inc., for the quarter ended March 31 were $57,893,000, as compared with $57,338,000 in 1925. During the first three months of 1926 orders received by the company aggregated $61,057,000, compared with $57,881,000 during the corresponding period of 1926. The orders at hand on March 31, 1926, amounted to $93,983,000, compared with $87,079,000 on March 31, 1925.

Probe of Electric Refrigeration Is Welcomed, Says President Goss

The Electric Refrigeration Corporation, Buhl Building, Detroit, is one of the concerns named in a resolution introduced in Congress by Senator Walsh of Montana asking for a sweeping federal trade investigation in the case of numerous recent industrial combines. The Electric Refrigeration Corporation was formed last year as a merger of the Kelvinator Corporation, the Nizer Corporation and the Grand Rapids Refrigerator Company. President Goss in referring to Senator Walsh's resolution stated that he welcomed such an investigation and made the following comment: "The motive behind our merger was not an endeavor to eliminate or reduce competition, nor an endeavor to evade anti-trust laws, but solely the purpose of gaining economy of operation through the co-ordination of competent divisions participating in all branches of the electric refrigeration industry."

Graybar Electric to Open Three New Distributing Branches

Three additional branches to be located at Reading, Pa., Dayton, Ohio, and Hartford, Conn., have been announced by the Graybar Electric Company. It is expected that these new branches will be in operation this spring, thus giving the company a total of 58 distributing branches throughout the country. "The policy of establishing new distributing houses is in accordance with our policy of natural expansion," said G. E. Cullinan, vice-president in charge of sales. "As the electrical needs of a territory grow—in particular those sections which are not already adequately served by existing Graybar warehouses—new ones, strategically placed, are opened."

Curtis Lighting, Inc., 1119 West Jackson Boulevard, Chicago, announces that it has placed on the market a new fixture, the "X-Ray" control ring No. 13351, which when attached to the "X-Ray" show-window reflector No. 33 or the "X-Ray" projector No. 51 converts the unit into a spotlight.

The Link-Belt Company, 910 South Michigan Avenue, Chicago, announces that Nelson Brandt has rejoined its sales management force and will manage a new branch office which will be opened in Florida at or in the vicinity of either Jacksonville or Orlando.

The Walker & Pratt Manufacturing Company, 31 Union Street, Boston, announces the development of a thermostatic temperature control device for electric ranges. The device can also be set by means of a timing clock.

The General Electric Company announces that it has placed on the market a new vacuum cleaner of the suction type. It is the first time that the company itself has produced a vacuum cleaner.

The Riley Stoker Corporation, Worcester, Mass., announces that O. C. Sheldon, formerly advertising manager, has been transferred to the Cincinnati office of the company as district manager. Mr. Sheldon has been associated with the corporation for the past ten years and formerly served in the engineering department. C. L. Smith, formerly district manager of the Cincinnati office, has been transferred to the Chicago office as district manager.

The Westinghouse Electric & Manufacturing Company announces that it has acquired the exclusive United States rights to a new process, known as the Backer process, for insulating the element of an electrical heating device. This process is particularly applicable to elements for water heaters and hot plates. The heating elements made by the Backer process are given the name "Pyrox." This type of heating element is now being used by the Westinghouse company in its ranges, bayonet water heaters and tumbler water heaters.

The Eldredge Electric Manufacturing Company, 3 Post Office Square, Springfield, Mass., has been reorganized as the Eldredge Electrical Corporation with the following officers: A. Linton Bausman, president; Guy Boynton, vice-president, and H. C. Hyde, treasurer and general manager. To the regular line of miniature precision meters which the company has long been building has been added a solenoid relay switch used in series with street-lighting circuits in supplying 110-volt current to traffic signals and semaphores.

The Triumph Electric Company, Cincinnati, manufacturer of motors, announces that E. W. Martin has been appointed district manager of the Chicago office, at 21 East Van Buren Street. Mr. Martin formerly served in various capacities with the Westinghouse Electric & Manufacturing Company.

The Triangle Conduit Company, Inc., Dry Harbor Road and Cooper Avenue, Brooklyn, N. Y., manufacturer of armored cable, rubber-covered wire, etc., announces that it has placed on the market the Triangle armored cable tool for quickly and easily stripping any single-strip armored cable. The tool also has an auxiliary pair of wide-mouth pliers which perform all

the functions of ordinary gas pliers and a cutting device which cuts wire, cable or non-metallic conduit up to ½ in.

The Domestic Electric Company, 7223 St. Clair Avenue, Cleveland, manufacturer of fractional horsepower motors, is having plans prepared for the erection of a two-story factory addition, 40 ft. x 100 ft.

The Westinghouse Electric & Manufacturing Company announces that Louis Hausmann, formerly in the general engineering department of the South Philadelphia works of the company, has been appointed a power engineer in the Chicago district office. The company also announces that J. C. Woodson, formerly section engineer in charge of industrial heating, has been appointed manager of the industrial heating engineering department.

Kelvinator, Boston, Inc., has recently been organized as a distributing organization for the Kelvinator Corporation and has established a wholesale branch office and stockroom at 185 Albany Street, Cambridge, Mass. At this office there has been set up a permanent sales school for training field representatives, dealer service and installation men. Charles Gould is general manager of the new organization.

The Eureka Vacuum Cleaner Company, Detroit, has opened an office in Atlanta at 31 Houston Street as headquarters for its Southeastern division. The Southeastern division is composed of Georgia, Florida, Alabama, Tennessee and Mississippi and is in charge of C. J. DeKlyne. This office has also leased a warehouse to carry stocks for the Southeastern requirements.

Paul W. Koch & Company, 19 South Wells Street, Chicago, announces that it has placed on the market a new "Jiffy" combination pipe bender vise that will bend ½-in. and ¾-in. conduit to a radius as small as 2 in.

The Graybar Electric Company, 100 East Forty-second Street, New York, announces the appointment of J. L. Ray, formerly manager of the supply and equipment department, as general supply sales manager. The company also announces the appointment of E. A. Hawkins as general telephone and appliance sales manager.

The Westinghouse Electric & Manufacturing Company announces that F. H. Robb, formerly automotive service superintendent, has been appointed New England service sales division manager of the company with headquarters at Boston.

The Boiler Engineering Company, manufacturer of the "Beco" boiler baffle wall and "Canady" combustion control, announces its removal from its old quarters at 760 Broad Street, Newark, N. J., to larger offices at 931 Federal Trust Building.

The Ideal Electric & Manufacturing Company, Mansfield, Ohio, manufacturer of direct-current and alternating-current power apparatus, announces the following change in its organization: E. W. Rowland, formerly manager of the New York office, has been appointed district sales manager for the Eastern district; L. C. Leonard, formerly with the Dudley-Curry Company, New York, has been appointed to assist Mr. Rowland in New York, and O. E. Dunnum will have charge of the Philadelphia office.

Pass & Seymour, Inc., Solvay Station, Syracuse, N. Y., manufacturer of wiring devices, announces a new canopy switch, No. 3310, and also receptacles, Nos. 4103 and 4135, with the new corner angle slot especially designed for use in lighting fixtures such as shallow ceiling pans and units with limited wiring space.

The Triumph Electric Company, Cincinnati, manufacturer of motors, announces the appointment of the Blake Electric Manufacturing Company, 255 Atlantic Avenue, Boston, as its New England sales agent.

New Equipment Available

Car Spotter

A new vertical-capstan self-contained electric motor-driven car spotter, called the Caldwell car spotter, has been placed on the market by the H. W. Caldwell & Son Company, 1700 South Western Avenue, Chicago. The unit is for use in spotting cars for loading and unloading and is adapted to the handling of coal at central-station plants. New applications have also been continually developing, as, for instance, the moving of materials in lumber yards, steel mills, foundries, in logging work and on the docks. The capstan has a 360-deg. working radius and is made in two sizes, No. 1 and No. 2. The former has a speed of 40 ft. to 60 ft. per minute while moving one, two or three cars, and the latter a speed of 26 ft. to 42 ft. per minute while moving between three and six cars. The spotter is provided with an automatic oiling system.

New Switchboard Fixtures

A new line of adjustable supports for wiring installations for permanent or temporary work, and which may be used on timber masonry, structural steel or pipe framework, has been placed on the market by the General Electric Company. The rods, of ½ in. cold-rolled steel, which may be cut to any length, are used with two forms of supports, the wedge-shaped castings for pipe or a slotted casting to fit the edge of I-beam flanges. A clamp in the form of an elongated U (a short piece of strap iron turned up at the ends) is used to clamp the rods to the supports. This clamp is also used in clamping apparatus to the rods. The slotted castings for I-beam flanges may also be used on flanges of most of the conventional structural steel shapes. The support is fixed in position by means of a setscrew. This use of a setscrew also allows the ready removal of the support at any time. By substituting lag screws and round spacers in place of the supports the fixture may be used in wooden timbers or planking. Expansion bolts and spacers adapt the fixture to brick, concrete or other masonry.

System for Automatic Operation of Refrigeration Machinery

A system for providing full automatic operation of refrigerating and other machinery has been developed by the Henkerbak Syndicate, Ltd., 13 Madoerastraat, The Hague, Holland. This device consists essentially of a liquid-flow regulating controller and thermostat, the regulating part of the controller being connected to the cooling-water system and the thermostatic part to the cooling chamber, and a hydro-electric switch. Under thermostatic action the regulating controller valve is operated and allows water to flow to the hydro-electric switch, which even under the pressure of a slight flow of water will operate. The hydro-electric switch comprises as its hydraulic part a metal cylinder in which a bypass, a piston and levers are placed, and as its electrical part a special design of quick-make-and-break switch associated with a cylinder.

Elevating Platform Trucks

A new elevating platform truck, designated as the Yale K23E, has been brought out by the Yale & Towne Manufacturing Company, Stamford, Conn. This truck is designed primarily to carry the heavy loads that are found in many industries. This machine is not of the high-lift type, such as the Yale K22, but it does embody the self-loading feature. The short turning radius and the narrow width of this machine is said to make it easy to drive in and out of box cars or narrow aisles. Hardened steel steering pivots with bronze bushings and the high-pressure lubricating system reduces friction and makes steering easy, even when carrying a full load.

The triple spur-gear elevating mechanism consists essentially of the same unit as is used in the K22 truck, making the major replacement parts interchangeable between models. The elevating platform is quickly raised by means of two large eccentrics mounted on the hoist unit shaft, which draw the platform forward and upward on the platform links. The majority of parts, units and sub-assemblies of this truck are standard and interchangeable with those of all other models in the K-series manufactured by the company.

Temperature Overload Relay.—The TC-121 temperature overload relay made by the General Electric Company has been redesigned and will be known as the form C, or TC-121-C. This relay has two heating elements connected in each two phases. On direct-current circuits the heating elements are connected on each side of the line. The improvements in design allow the use of renewable heating elements, prevent the bending of thermostatic strips by operators and include a better mechanical construction. The relay is reset by means of a cord and button suspended from the bottom.

New Trade Literature

AUTOMATIC RECLOSING CIRCUIT BREAKER.—Bulletin No. 202 issued by the Automatic Switch Company, 517 East Larned Street, Detroit, describes the application of its type "MI," motor operated, indoor, automatic reclosing circuit breaker to the protection of outgoing substation feeders.

STATIC CONDENSERS.—Booklet 1,670-A issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes and illustrates the Westinghouse static condensers for power-factor correction. It contains a discussion of power factor, its correction and the selection of corrective equipment; it also describes the "LD" static condensers. A section is devoted to low-voltage static condensers, describing their construction, assembly and application. A number of tables and charts are included.

CAST-IRON PIPE.—The American Cast Iron Pipe Company, Birmingham, Ala., is distributing a booklet containing specifications of "Acipco Mono-cast" centrifugal pipe, which in all essential points are in complete conformity with the specifications of the American Water Works Association, the American Society for Testing Materials, the New England Water Works Association and the American Gas Association.

ILLUMINATING EQUIPMENT. — "Illuminating Equipment for Land-Sea-Air" is the title of a booklet issued by the B. R. T. Corporation of America, Atlantic Building, Philadelphia, covering its floodlighting equipment for the lighting of landing fields for night flying, docks or large areas of land or water, etc. The company is also distributing a catalog describing the Barbier, Benard & Turenne "Scialytic" shadowless hospital operating light, which was developed with the object of obtaining over a given area an illumination of high intensity which shall be entirely free from shadows.

COMBINED SWITCH AND CUTOUT.—The Mutual Electric & Machine Company, 7610 Joseph Campau Avenue, Detroit, is distributing bulletin No. 104, describing the "Bull Dog SAFtoFUSE," a combined switch and cut-out, for safe fusing and safe switching, suitable for installing in kitchens and for electric ranges.

BAROMETER AND VACUUM RECORDER.—Bulletin No. 150 issued by the Uehling Instrument Company, 473 Getty Avenue, Paterson, N. J., desoribes the Uehling barometer and vacuum recorder for steam turbines. A full-size reproduction of an actual chart from an instrument installed in a textile plant is included.

VIBRATORY SCREEN.—Bulletin No. 25 issued by the Pittsburgh Coal Washer Company, Fulton Building, Pittsburgh, describes and illustrates the Pittsburgh vibratory screen for separating or sizing materials of all kinds. Illustrations are given showing the various arrangements of the vibratory screens. A line drawing showing the arrangement of a single-deck single unit is included.

BALL BEARINGS. — The Torrington Company, Torrington, Conn., is distributing a catalog and price list covering the Torrington ball bearings, including the magneto (open-type) single and double row and radial (closed type). Attention is called to a full-size scale drawing of all Torrington ball bearings.

FANS.—The Graybar Electric Company, 100 East Forty-second Street, New York City, has issued its 1926 fan catalog, covering the Graybar fans for alternating-current and direct-current circuits, non-oscillating, oscillating, ceiling and ventilating (exhaust) fans. It contains descriptive specifications of the various types of fans, and a table of weights is included.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Ancon, Panama (No. 20,074), of electric cloth-cutting machines.

Purchase and agency is desired in Venice, Italy (No. 20,044), of thin metal vest pocket flashlight cases.

Purchase is desired in Kovno, Lithuania (No. 20,064), of electric hair curlers.

An agency is desired in Bombay, India (No. 19,994), for electrical machinery.

Purchase or agency is desired in Berne, Switzerland (No. 20,043), of foot-candle meters.

Purchase and agency is desired in Ottawa, Canada (No. 20,090), of porcelain knobs and tubes.

An agency is desired in Swatow, China (No. 20,075), for wiring devices and material.

Purchase is desired in London, England (No. 19,994), of smoke abatement equipment.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

AUGUSTA, ME.—Plans are under way for the erection of a 33,000-volt transmission line to connect the properties of the Central Maine Power Company, Augusta, with the system of the Western Maine Power Company, Limerick.

BOSTON, MASS. — The Department of Public Works is considering plans for the installation of an improved lighting system on Massachusetts Avenue.

MANCHESTER, N. H. — Arrangements are being made by the Moores Falls Corporation for the construction of a large hydro-electric development at Moores Falls in Litchfield. Power generated at the plant will be supplied to the Amoskeag Mills.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Account Navy Department, Washington, D. C., until May 4, electric dryers, searchlights, etc., for the Navy Supply Depot.

GOVERNORS ISLAND, N. Y.—Bids will be received by the Signal Corps Procurement District, until May 7, for 19,000 ft. telephone cable, and 7 cable reels.

JORDAN, N. Y. — The Jordan Electric Light & Power Company has applied for permission to extend its transmission line to Van Buren and to erect a distribution system in the town and to exercise a franchise granted by the Town Board.

LA SALLE, N. Y.—Plans are being considered by the Village Board for extensions and improvements to the ornamental lighting system in the business section.

MATTEAWAN, N. Y.—The bill authorizing the creation of a debt from the permanent improvement bond issue of $750,000 for the acquisition of a site and the construction of a central power plant for the Matteawan State Hospital for the Criminal Insane has been signed.

NEW YORK, N. Y.—Bids will be received by C. S. White, purchasing agent, New York Central Railroad Company, Room 344, 466 Lexington Avenue, until May 7 for furnishing and installing one 500-kw. direct-current turbo-generator set together with generator and feeder switchboard panels, also relocation and alterations to the existing switchboard panels and generator and feeder wiring in power station, under serial contract No. 8-1926.

NEW YORK, N. Y.—The budget of the Long Island Railroad Company for 1926 provides for an expenditure of about $11,000,000. Among the projects to be started soon are the extension of the electrified system from Floral Park to Mineola, on the main line, and from Mineola to Valley Stream on the New York Bay extension, or the West Hempstead branch, at a cost of about $900,000. Preparations are being made to double track the Long Beach branch from East Rockaway to Wreck Lead, at a cost of about $340,000; also to install a second track on the Montauk division from Sayville to a point east of Patchogue, in addition to the construction of a storage yard and an engine terminal, to cost more than $500,000.

RAYBROOK, N. Y.—The bill providing for the sale of bonds out of the permanent improvement bond issue to the amount of $200,000 for the construction of a power house at the New York State Hospital for the Treatment of Incipient Pulmonary Tuberculosis at Raybrook, has been signed.

ROCHESTER, N. Y.—Plans are being prepared by the Rochester Realty Company, care of Dow, Harlow & Kimball, architects, 184 Boylston Street, Boston, for store, office and apartment building, including lighting plant, to cost about $150,000.

UTICA, N. Y.—The Utica Gas & Electric Company has applied for permission to extend its transmission lines to Westmoreland and for approval of a franchise to serve electricity in the town.

WIRT, N. Y.—The Niagara, Lockport & Ontario Power Company, Buffalo, plans extensions in its transmission line for commercial service at Wirt, Clarksville and vicinity, where local franchises have been secured.

MILLBURN, N. J.—The Board of Trade is negotiating with the Township Committee for the installation of ornamental lamps on Millburn Avenue, from Spring to Holmes Street.

NEWARK, N. J. — The Public Service Electric & Gas Corporation has filed a construction and improvements program for 1926 with the Public Utilities Commission, providing for an expenditure of about $50,000,000, including work under way.

PATERSON, N. J.—The City Council is planning to install a traffic signal system on all important streets. Capt. Charles F. Sautter, Police Traffic Bureau, will be in charge.

BRISTOL, PA. — The Bucks-Bensalem Electric Company, recently organized by B. P. Carey, 1000 Chestnut Street, Philadelphia, and associates, plans a number of transmission line extensions in Bucks County. The company has taken over the Bucks-Falls, Bucks-Bristol, Bucks-Hulmeville and the Bucks-Middleton Electric Companies.

CENTERVILLE, PA. — Permission has been granted the West Penn Power Company, Pittsburgh, to erect a transmission line over the Monongahela River at Centerville.

HARRISBURG, PA.—Bids will be received by the Secretary of the Department of Property and Supplies, Capitol Building, Harrisburg, until May 11, for electrical equipment and supplies for the fiscal year, beginning in June.

PHILADELPHIA, PA. — A permit has been granted the Philadelphia Electric Company for the construction of a substation at Juniper and Waverly Streets, to cost $105,000.

WEST WINFIELD, PA.—Electric power equipment will be installed in the proposed local cement mill to be erected by the West Penn Cement Company, Butler, recently organizd by C. S. Hosford, Jr., Butler, and associates, at a cost of about $1,200,000.

YORK HAVEN, PA.—The City Council has authorized the installation of an electric-operated traffic signal system.

BELLEVUE, D. C. — Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 4, for four motor generators (Schedule 5345).

WASHINGTON, D. C. — The Commissioners of the District of Columbia have authorized extensions and improvements to lighting system on Rhode Island Avenue N. W.

WASHINGTON, D. C. — The Potomac Electric Power Company plans to install a 30,000-kw. turbo-generator and four boilers of 1,400 hp. capacity each, with interdeck superheaters, water-cooled furnace walls and air preheaters in its Bennings power station. Stone & Webster, Inc., Boston, is designing and constructing engineer.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 4, for two electric dryers, for the Boston navy yard; 10 electric dryers for the Brooklyn navy yard; one for the Philadelphia navy yard; two for Norfolk navy yard; and six electric blowers and 13 electric dryers for the Puget Sound navy yard. (Schedule 5288.)

North Central States

MARQUETTE, MICH.—The installation of new lamps on Fair Avenue and Washington Street is under consideration by the City Council.

AKRON, OHIO.—Bids will be asked by W. F. Peters, director of public service for grading, curbing, walks and ornamental lighting system, etc., on Orlando Avenue, to cost about $48,900.

CLEVELAND, OHIO.—The Lake Erie Power & Light Company, recently organized to take over the light and power

business of the Lake Shore Electric Railway Company, which operates an electric railway between Cleveland and Toledo, plans to erect a high-tension line feeding the Fremont and Woodville districts. Further developments paralleling Lake Erie and reaching almost across Ohio are contemplated by the new company. The company has also acquired the properties of the Bellevue Illuminating Company, Bellevue Light & Power Company and the People's Light & Power Company, which supply Bellevue, Castalia, Vermillion, Berlin Heights, Avon Lake and Bay Village districts. Charles S. Thrasher is president of the company.

DEFIANCE, OHIO.—Plans for the proposed sugar refining plant to be built by the Farmers' Sugar Company include a power plant.

GALLIPOLIS, OHIO. — Work will soon begin on the construction of a power plant at the local State Institution for Epileptics, to cost about $40,000. The Department of Public Welfare, Columbus, is in charge.

LOTHAIR, KY.—The Kentucky & West Virginia Power Company, Hazard, plans extensions to its local power plant, including the installation of additional equipment.

EAST MOLINE, ILL.—The installation of ornamental lamps on Fifth Avenue, from Seventh Street to Twelfth Street, to cost $13,500, is under consideration.

LOOGOOTEE, IND.—The Interstate Public Service Company, Indianapolis, has purchased the municipal electric plant. Service for the local system will be obtained from the Edwardsport-Petersburg transmission line.

CHICAGO, ILL. — At an election held April 13 the proposal to issue $2,000,000 in bonds for extending the street lighting system in the remaining developed territory in the outlying sixteen wards from the Indiana State line to Evanston was carried.

CHICAGO, ILL. — The Randolph Street Lighting Association plans to install a new lighting system on Randolph Street, between Wells Street and Michigan Avenue, using combination lamp and trolley standards. The cost is estimated at $85,000. Frank Bering, Hotel Sherman, is president of the organization.

CHRISTOPHER, ILL. — Authority has been granted the Central Illinois Public Service Company, Springfield, to erect a 6,600-volt transmission line from Christopher to Mulkeytown, and to build a distribution system in the latter town.

MANSFIELD, ILL.—Permission has been granted the Illinois Power & Light Corporation, Chicago, to purchase the municipal electric plant in Mahomet and the plant of the Mansfield (Ill.) Electric Company. The company was also authorized to erect a 6,600-volt transmission line north from Normal to Towanda, with a distribution system in the latter city.

SPRINGFIELD, ILL.—Extensions and improvements are contemplated to the municipal distribution system, to cost about $50,000, by the City Council. William J. Spaulding is commissioner of public properties.

FRANKSVILLE, WIS.—A petition has been presented to the Town Board for the installation of a street-lighting system in the village.

CAMBRIDGE, MINN. — Bids will be received by the Minnesota State Department of Administration and Finance, Room 327 State Capitol, St. Paul, for construction of the Administrative Center Group, Minnesota Colony for Epileptics, Cambridge, including a power plant. C. H. Johnstown, 718 Capital Bank Building, St. Paul, is architect, and the Pillsbury Engineering Company, 2,344 Nicollet Avenue, Minneapolis, is engineer.

CANTON, MO.—At an election to be held May 4 the proposal to issue $15,000 in bonds for the installation of an ornamental lighting system will be submitted to the voters.

CAPE GIRARDEAU, MO.—The Community Power & Light Company contemplates additions and improvements in its system, including transmission line extensions.

ST. LOUIS, MO.—Bids will be received by the Board of Trustees until May 4 for furnishing materials for construction of substations B, C and D for street lighting system.

ST. LOUIS, MO.—Plans have been filed by the Union Electric Light & Power Company for the construction of a substation on North Newstead Street.

MILLER, S. D.—Bids will be received by D. C. Briggs, city auditor, until May 10, for extensions and improvements in the municipal electric plant, including one 200-250 kw. steam engine generating unit, with switchboard and auxiliary equipment. Earle D. Jackson, St. Paul, Minn., is consulting engineer.

OMAHA, NEB.—Plans have been filed by the Nebraska Power Company for the construction of a substation at Fifty-second and Erskine Streets.

ALEXANDER, KAN.—The City Council plans to erect a transmission line from McCracken to secure electricity for light and power service. The cost is estimated at $30,000.

EMPORIA, KAN.—Surveys are being made by the Kansas Electric Power Company, Lawrence, with a view of erecting a new transmission line from its local plant to the Madison oil fields. The proposed line will be 22 miles long and will carry 33,000 volts. The company plans to remodel the substation and install automatic reclosing oil circuit breakers.

PARSONS, KAN.—The Kansas Electric Power Company, Lawrence, plans to extend its transmission lines from its local plant to Bartlett.

Southern States

CHARLOTTE, N. C. — The "Charlotte Observer," Charlotte, plans to install electric power equipment in its proposed new printing plant, to cost about $400,000. Lockwood, Greene & Company, Johnston Building, are architects and engineers.

WASHINGTON, N. C.—The Bath Electrical Company, recently organized with a capital stock, plans to erect transmission lines between Washington, Bath, Bayview and other towns. A. Bowers and A. D. McLean are interested in the project.

WILMINGTON, N. C.—Plans are being considered by the Board of City Commissioners for improvements to the ornamental lighting system. It is proposed to remove all wires from Front Street and to replace the present poles with all-steel poles. Street-lighting service is furnished by the Tide Water Power Company.

CHESTER, S. C.—The City Council is considering the installation of an ornamental lighting system on the main thoroughfares.

CAVE SPRING, GA.—The Georgia Railway & Power Company, Atlanta, which has purchased the local electric distribution system, plans to erect a high-tension line from Lindale, a distance of 12 miles, to supply electricity here.

HOMERVILLE, GA.—The Ware County Light & Power Company, Waycross, which has been granted a franchise to supply electricity in Homerville, plans to extend its transmission line here and to build a substation.

JESSUP, GA.—The Ware County Light & Power Company, Waycross, which is negotiating for the municipal electric plant, plans to extend its transmission line here, for local service.

JACKSONVILLE, FLA.—Bids will be received by Frank H. Owen, chairman, until May 5 for switchboard equipment in connection with substations for the municipal electric light system.

OCALA, FLA.—At an election to be held May 4 the proposal to issue $25,000 in bonds for extensions to the municipal electric light and power lines will be submitted to the voters.

TALLAHASSEE, FLA. — The Federal Power Commission has granted the West Florida Power Company a preliminary permit for a proposed power project on the Ocklocknee River in Gadsden and Leon Counties. The plans include the construction of a dam and power house, near Bloxham, to supply electricity in Tallahassee and nearby towns.

TAMPA, FLA.—Plans are being prepared by the Tampa Electric Company for an addition to its electric power plant on Parker Street, including the installation of new equipment, to cost $125,000. The Stone & Webster Engineering Company, 147 Milk Street, Boston, is engineer.

SILVERHILL, ALA. — The Silverhill Power Company has petitioned the Public Service Commission for permission to build a hydro-electric power plant.

BILOXI, MISS.—The installation of a municipal electric plant is under consideration by the City Council.

YAZOO CITY, MISS.—The General Utilities Company, recently organized, plans to build a steam-operated electric plant for service in this section.

FRANKLIN, LA.—Bonds to the amount of $140,000 have been voted for extensions and improvements to the municipal electric plant and waterworks system.

NEW ORLEANS, LA.—The Penick & Ford Company, Ltd., plans extensions and improvements in the electric power plant at its local food products factory, including the installation of new equipment. Fred Friedline, Kentland, Ind., is engineer.

BUFFALO, OKLA.—Sherritt & Company, 160 North La Salle Street, Chicago, which recently acquired the local electric and ice plant plans to increase the output of the electric plant and to double the capacity of the ice factory.

ABILENE, TEX.—The Abilene Cotton Oil Company, recently organized, plans to install electric power equipment in its proposed local cotton seed oil mill, to cost about $300,000.

EDINBURG, TEX.—The Valley Electric & Ice Company, San Benito, which is negotiating for the purchase of the municipal electric plant, plans extensions in its transmission line for local service.

Pacific and Mountain States

PORT ANGELES, WASH.—The Washington Pulp & Paper Corporation plans to install electric power equipment in proposed additions to its mill, to cost about $1,000,000. V. D. Simons, 431 North Dearborn Street, Chicago, is engineer.

PORTLAND, ORE.—The Oregon Box & Lumber Company, 1144 Macadam Road, plans to install electric power equipment in connection with the rebuilding of its plant, recently damaged by fire. The cost is estimated at $250,000.

MONROVIA, CAL.—The Board of City Trustees has approved the installation of ornamental lamps on King Street, between Mayflower and Ninth Avenues, using reinforced-concrete standards.

RIVERSIDE, CAL.—The Board of City Trustees has adopted a resolution providing for the installation of ornamental lamps on New Magnolia Avenue, Fourteenth, Market and other streets.

SACRAMENTO, CAL. — Three plans affecting the development of power in connection with the Silver Creek domestic water-supply project of the city of Sacramento have been submitted to the board of directors of the municipal utility district by the engineers employed to report on the feasibility of generating electricity. Plan No. 1, to cost about $10,600,000, does not contemplate power development. Plan No. 2, to cost about $14,800,000, calls for the development of three plants along the aqueduct, to have a combined capacity of 14,200 hp. Plan No. 3 would permit the installation of 91,534 hp., and would cost about $27,100,000, exclusive of an electrical distribution system. Before making any definite recommendations as to power plant capacities the board of consulting engineers desires information as to the possible revenue to be derived from the sale of power. The utility district proposes to solicit bids from local utility companies.

SAN DIMAS, CAL.—Bids will soon be asked by the Board of City Trustees for the installation of an ornamental lighting system in the business district.

VERNAL, UTAH.—Plans have been approved by the town officials for the installation of a new street-lighting system, to be installed this summer.

BRIGHTON, COL.—The City Council has contracted with the Public Service Company of Colorado, Denver, for furnishing electrical service for five years. Arrangements for street-lighting service will be made later on.

COLORADO SPRINGS, COL.—According to the quarterly report of the Municipal Light and Power Department submitted by Earl Mosley, manager, to the City Council an additional outlay of $150,000 will be required to complete the rehabilitation of the municipal electric distribution system.

Canada

TORONTO, ONT.—Plans are under consideration by the Hydro-Electric Power Commission for a hydro-electric development at Chat Falls on the Ottawa River, in the near future.

CHELSEA, QUE.—The Gatineau Power Company, a subsidiary of the International Paper Company, 100 East Forty-second Street, New York City, which is building power plants on the Gatineau River at Chelsea and Farmer's Rapids, contemplates a large hydro-electric development at Paugan Falls, a few miles farther up the Gatineau River.

Electrical Patents

Announced by U. S. Patent Office

(Issued March 30, 1926)

1,579,097. COMMUTATOR AND SLIP-RING BRUSH SHUNT CONNECTION; H. H. Erdman, Ridgway, Pa. App. filed April 14, 1925.

1,579,118. ELECTRODE END CAP; E. Kleinmann, Berlin, Germany. App. filed April 20, 1925.

1,579,138. ELECTROLYTIC CELL; F. Petz, Nuremberg, Germany. App. filed July 18, 1924. Cement-trough type.

1,579,174. INSULATOR; M. F. Gouverneur, Rochester, N. Y. App. filed July 29, 1919. Suspension units.

(Issued April 6, 1926)

16,309 (reissue). ELECTRIC SADIRON; M. Murphy, Rushville, Ind. App. filed April 9, 1924.

1,579,228. PRIMARY CELL AND ELEMENT THEREOF; M. L. Martus, Woodbury, Conn., and J. G. Ross and E. H. Becker, Waterbury, Conn. App. filed May 24, 1923. Heavy-duty primary cell employing copper oxide as a depolarizer, and an alkaline electrolyte.

1,579,232. ELECTRIC SWITCHING DEVICE; J. L. Milton, Louisville, Ky. App. filed April 17, 1922. Solenoid for operating the tongues of switches.

1,579,255. AUTOMATIC SWITCH; R. D. Smith, Scarsdale, N. Y. App. filed June 21, 1922. For thermo-electric control.

1,579,286. DYNAMO-ELECTRIC MACHINE; O. L. Dupy, New York, N. Y. App. filed March 15, 1924. Self-starting and will run in synchronism with the supply current when synchronous speed is reached.

1,579,344. TRANSFORMER; J. C. Armor, West View Borough, Pa. App. filed Dec. 7, 1921. Intended for use in electric welding. Characterized by a slidable mounting of one of the windings, preferably the secondary winding, in relation to the other winding, whereby the amount of current induced in the secondary winding may be regulated to meet the working conditions.

1,579,361. ELECTRIC SNAP SWITCH; N. G. Hayes, Stratford, Conn. App. filed Dec. 15, 1925. Toggle type.

1,579,369. BATTERY CARRIER AND CONNECTER; H. Koch and F. H. Wohlers, Jamaica, N. Y. App. filed Aug. 23, 1921. For a number of dry cells combined into a portable battery unit.

1,579,400. TERMINAL BLOCK; M. M. Samuels, New York, N. Y. App. filed June 5, 1923. Into which are molded individual metal terminal plates. These terminal plates have suitable binding posts for wires and are separated from each other by barriers running parallel to them and forming with the terminal block one single molding. Across the terminal block is fastened a labeling plate, preferably of insulating material. By suitable inscription on this labeling plate the various wires and cables running to the terminal board may be easily identified.

1,579,402. ELECTRIC HEATER; J. Schenfeld, Alameda, Cal. App. filed July 2, 1923. Bowl type.

1,579,476. ELECTRIC FURNACE; M. D. Dominiquez, New Orleans, La. App. filed May 12, 1924. Adapted for heating rivets, soldering coppers and other articles or objects; for melting metals which melt at moderate temperatures.

1,579,494. CABLE STRUCTURE; D. M. Simons, Osborne, Pa. App. filed March 19, 1926. The union of successive lengths of hollow conductor.

1,579,505. ELECTRICAL SYSTEM; W. F. Bouche, Lancaster, N. Y. App. filed July 29, 1921. Generator-storage-battery system.

1,579,596. ELECTRIC FUSE AND METHOD OF PREPARING SAME; T. F. Cote, Chicago, Ill. App. filed Oct. 13, 1921. Having the surface tension thereof increased above the normal degree, so that upon short-circuiting the degree of arcing will be materially reduced.

1,579,618. OUTLET FOR WIRES; V. G. Jensen, Chicago, Ill. App. filed Dec. 16, 1924. Conduit fitting.

1,579,643. COMMUTATING GEAR OF HIGH-TENSION DIRECT-CURRENT APPARATUS; J. E. Calverley, Preston, England, and W. E. Highfield, London, England. App. filed June 15, 1925. Insulation and mounting of the brush gear for these commutators.

1,579,651. CONTROL SYSTEM; R. C. Deale, Plainfield, N. J. App. filed Oct. 20, 1923. For governing the operation of machine tools.

1,579,662. ELECTRICAL TIME SWITCH; J. J. Ruddick, West Newton, Mass. App. filed Feb. 24, 1922. In which the switch is controlled by a detent which in turn is controlled by two motors, one of which is in the form of an electromagnet having an armature movable relatively to the detent but adapted to effect the movement of the detent in both directions.

1,579,687. SWITCH-OPERATING MECHANISM; C. H. Bissell, Syracuse, N. Y. App. filed Oct. 23, 1923. Switch operating and locking mechanism for holding the switch in "on" position and locking and releasing means, for holding and releasing, when operated, the handle and the switch.

1,579,721. WELDING APPARATUS; F. H. Leslie, Chicago, Ill. App. filed April 11, 1925. Electric resistance welding machine, adapted to generate its own welding current, and one which may be driven from a source of comparatively low power supply, such as a line shaft, or by a small electric motor operating on an ordinary lighting circuit.

1,579,732. ELECTRIC HEATING UNIT; F. E. Owen, East Palestine, Ohio. App. filed Aug. 2, 1924. Semi-incased heating unit such as is used in a fireless cooker.

1,579,733. INSULATOR FOR BATTERY PLATES; R. B. Owen, Washington, D. C. App. filed Nov. 21, 1919.

1,579,745. CONTROL MECHANISM FOR ELECTRIC SWITCHES; A. E. Anderson, Milton, Mass. App. filed Sept. 22, 1923. Control mechanism for a plurality of switches governing a plurality of circuits, whereby one or more switches is or are locked in one position when one or more of the other switches is or are unlocked and in a different position.

1,579,808. ARMATURE-WINDING MACHINE; P. E. Chapman, St. Louis, Mo. App. filed March 18, 1921.

1,579,824. ELECTRODE CONSISTING OF LENGTHS THAT CAN BE JOINED TOGETHER; A. H. Laurell, Djursholm, Sweden. App. filed July 12, 1924.

1,579,865. FOUR-DOOR DUPLEX FLUSH RECEPTACLE; H. Hubbell, Bridgeport, Conn. App. filed May 15, 1920.

1,579,870. ELECTRIC SIGN SWITCH; J. Klasnich and J. J. Zwalsh, Cleveland, Ohio. App. filed July 29, 1922. Automatic.

1,579,882. ELECTRIC HEATER; E. Millner, St. Louis, Mo. App. filed Aug. 2, 1919. Comprising a heating element or unit and a heat-radiating casing or housing for the element of few readily assembled and complementing sections, so constructed and co-operating with each other and with the heating element that the several parts may be taken apart or separated and a renewal or substitution of the heating element readily made.

1,579,883. REACTANCE COIL; T. E. Murray, Brooklyn, N. Y. App. filed Nov. 19, 1920.

1,579,897. ELECTRIC LIGHTING FIXTURE; W. Symmes, San Francisco, Cal. App. filed Oct. 20, 1924. Having a bowl or acorn of non-transparent translucent material, which is illuminated by an electric lamp contained within the fixture.

1,579,986. THERMOSTATIC CIRCUIT CLOSER AND BREAKER; G. White, Chapel Hill, Tenn. App. filed Jan. 10, 1925.

1,580,020. ELECTRIC WELDING APPARATUS; A. E. Cutler and P. A. Marsden, Newcastle, New South Wales, Australia. App. filed July 24, 1923. For the production of electric arc welds of various types.

1,580,022. DYNAMO-ELECTRIC MACHINE; J. F. Douglas and E. W. Kane, Milwaukee, Wis. App. filed Feb. 14, 1924. Of the synchronous type. Shaping of the pole shoe near the tip in order to secure a better wave form of induced electromotive force, that is, one that deviates less from true sine wave, or other desired waves of flux density which do not deviate more than 10 per cent from the theoretical true sine wave and deviate only in such a manner that the components which interfere with telephone circuits are either eliminated or greatly reduced.

1,580,025. ELECTROMAGNETICALLY CONTROLLED DEVICE; J. Eaton, Schenectady, N. Y. App. filed Sept. 29, 1921. In which a controlled member biased to one position is magnetically held in a second position when the energization of an electromagnet is above a predetermined minimum value and arranged so that when the energization of the electromagnet is above predetermined maximum value the controlled member is directly operated away from the second position.

1,580,047. DISCONNECTING SWITCH; S. N. Jordan, Burlington, Iowa. App. filed June 5, 1924. Using only one insulator for insulating switch parts and deadending the wires, the strain of the latter being exerted in a straight line at opposite ends of the insulator, so as to have no shearing effect on the latter.

1,580,060. ELECTRIC FURNACE AND THE LIKE; W. A. Loke, Lambeth, England. App. filed June 2, 1925. For the treatment of finely divided ores, such as iron sand, titaniferous iron ores and the like.

1,580,086. TRAVERSER MECHANISM FOR COIL-WINDING MACHINES; D. Macadie, London, England. App. filed Jan. 16, 1923.

1,580,090. ELECTRIC HEATER; M. H. Schoenberg, San Francisco, Cal. App. filed Feb. 15, 1919. Bowl type.

(Issued April 13, 1926)

1,580,119. TIME SWITCH; H. W. Daggs, Cleveland, Ohio. App. filed Sept. 12, 1924. Having a sectional housing which when assembled provides a moisture-proof protector.

1,580,160. STARTING SWITCH; L. M. Persons, Quincy, Ill. App. filed Oct. 20, 1920. For single-phase motors.

1,580,244. ELECTRIC TOASTER; A. Guissart and E. H. Barb, New York, N. Y. App. filed June 2, 1922. Having an automatic control for the current supply regulated by the position of the bread holders relative to the heating unit.

1,580,293. ELECTRICALLY OPERATED STEAM BOILER; L. A. Fitzer, Los Angeles, Cal. App. filed Feb. 9, 1925.

1,580,313. ELECTRICAL SIGNALING DEVICE; M. W. McIntire, Wilmington, N. C. App. filed July 18, 1923. Whereby the condition of an electrical circuit may be indicated at a remote point.

1,580,334. ELECTRIC CABINET; G. F. Rohn, Milwaukee, Wis. App. filed Jan. 30, 1922. In which the covers or inclosures of the wiring compartment may be removed from the cabinet through the opening afforded by the door without disturbing other parts of the cabinet, and having adjustable means for connecting the face plate to the body of the cabinet.

1,580,339. INSULATOR SUPPORT; E. O. Sessions, Chicago, Ill. App. filed June 13, 1919. Adjustable relatively to and removable from its supporting base, thus permitting the bases of such supports to be installed before the clamping members and insulators are put in place.

1,580,368. SPEED-REGULATOR SYSTEM; C. A. Boddie, Pittsburgh, Pa. App. filed Nov. 12, 1920. Comprises a main propelling motor and a main control element having an electromagnet basically excited from any suitable constant-potential source and additionally excited in accordance with the speed of the main motor for so governing the excitation of the main motor as to maintain its speed substantially constant.

1,580,386. APPARATUS FOR UTILIZATION OF EXCESSIVE POWER AT ELECTRIC SOURCES; H. Silo, Nagoya, Japan. App. filed June 12, 1923. Auxiliary load is automatically controlled by means of an electric motor or motors connected with a relay which is adapted to regulate directly the amount of auxiliary load in accordance with the variation of the main load.

1,580,392. AUTOMATIC STATION; R. J. Wensley, Edgewood Park Pa. App. filed Jan. 16, 1924. Excitation and controlling means for such stations.

1,580,395. HEATER FOR STEEL LADLES; J. C. Woodson, Mansfield, Ohio. App. filed Oct. 6, 1922. Portable electric heater of relatively large capacity for drying linings of steel ladles.

1,580,401. ELECTRIC WELDING DEVICE; J. B. Borgadt, Cleveland, Ohio. App. filed Oct. 9, 1924. Resistance welder in which the current which is utilized for heating the material to the welding temperature can be caused to pass through the material being welded without arcing and without any appreciable loss of current due to poor contacts.

1,580,408. ELECTRICAL MEASURING INSTRUMENT; G. A. Cheetham, Manchester, England. App. filed May 18, 1918. Whereby the idle or reactive component of the volt-amperes or the time integral of this quantity may be measured in three-phase electric current distribution systems.

1,580,415. HORN-GAP SWITCH; H. J. Crabbs, Pittsburgh, Pa. and A. H. Barker Edgewood Park, Pa. App. filed June 5, 1922. Wherein the deflection set up during the opening and closing of the switch with which the horn is associated is distributed throughout substantially the entire length of the horn.

1,580,450. ELECTRICAL MEASURING INSTRUMENT; H. P. Sparkes, Wilkinsburg, Pa. App. filed Nov. 29, 1921. Power-factor meter.

1,580,457. MOTOR CONTROL CIRCUITS; V. H. Todd, Summit, N. J. App. filed June 24, 1924. For graphic-meter motors.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Giants of Industry

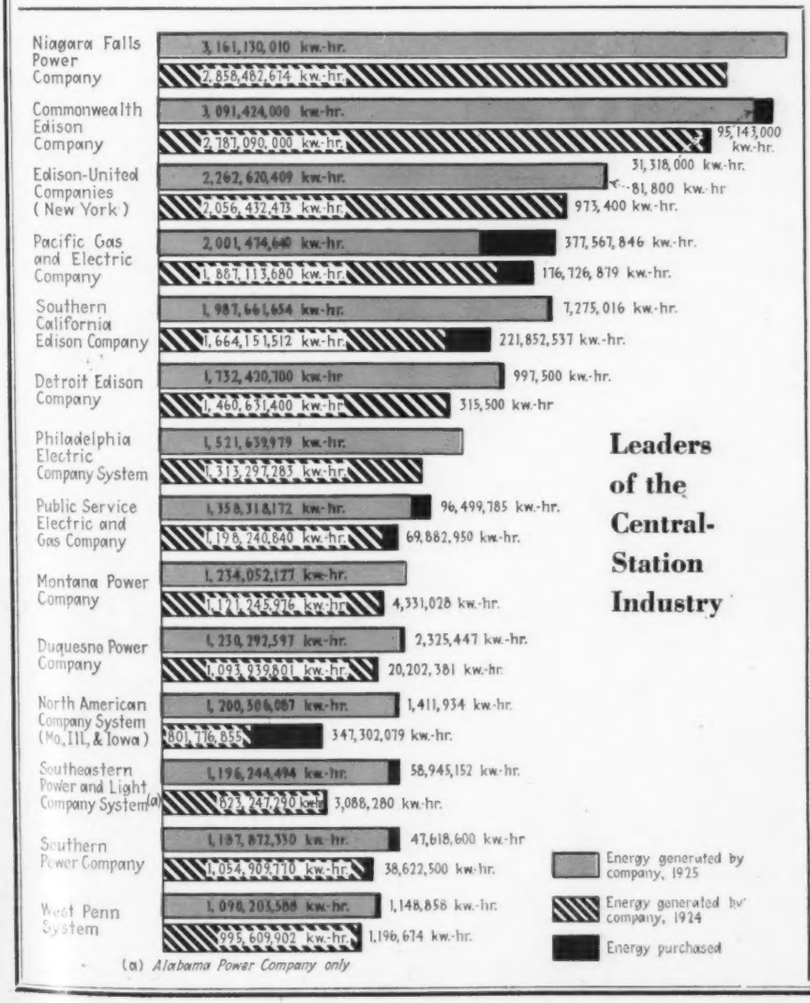
"There were giants in the earth in those days."—GENESIS VI, 4

EVERY age has brought forth its giants—giants of physique and strength, giants of intellect, and giants of economic and social accomplishments. Before the dawn of history the world was overrun by beasts of giant stature and strength, which in turn gave way to a race of mankind whose environment and continual fight for existence called for great physical development. Gradually the mind of man developed, bringing forth giants of finance, art, music and industry. And now these giant minds have created a new species of giant—the inanimate giant of industry. This is the age of great industrial giants—railroads, steel companies, oil companies—all developed to the highest point in their endeavor to serve mankind more efficiently.

The first half of the present decade has witnessed the creation of a new giant in industry—a family of giants, indeed, whose service to mankind bids fair to outshine that of all their rivals. In the electric light and power industry the nation has found a source of economic and social strength which has raised the American people and American industry to the highest plane of existence yet attained by mankind. This industry by its very name—"public service"—and through wise executive management has become recognized by the children of men as the "good giant."

It is but natural that as the result of more favorable environment certain members of this electrical family should assume a stature above that of their brothers. Concentration of industry into metropolitan areas, water powers of great potentialities, the development of irrigation in farming, extension of transmission systems—all have tended to create within the industry a class of large generating and distributing companies. As a result, the year just passed recorded 110 electric light and power companies with an output of more than a hundred million kilowatt-hours and fourteen companies with an annual output of more than a billion kilowatt-hours—truly, giants worthy of comparison with any which the earth has produced heretofore.

Such strength, however, calls for much careful thought, not only on the part of these giant companies, but by the industry as a whole. The central-station industry has so intertwined itself into the very economic fabric of the nation that every improvement in service and every wise move in policy will but put added life into the nation. The electric light and power industry has acquired the rôle of the nation's giant protector, and, as with Atlas of old, the task places large responsibilities upon the shoulders of those who direct its policies. The future development and prosperity of the nation depend very largely upon how efficiently the electric light and power industry meets its task of serving the American home and American industry.



(a) *Alabama Power Company only*

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

Industrial Activity in the Middle Atlantic States

THE ELECTRICAL WORLD presents herewith a new service for its readers in the Middle Atlantic States in the form of a barometer of activity in the various industries of that section. This barometer is based upon the energy consumption of about 500 large central-station power customers distributed throughout the section and in various industries. These monthly consumption data for each industry have been adjusted for seasonal variation and compared with the average monthly consumption during the 36-month period 1923-1925. The monthly activity in each industry has been weighted in accordance with the importance of that industry to obtain the general industrial activity of that section. A barometer for the country as a whole will be found on page 840 of the April 17 issue of the ELECTRICAL WORLD, and similar barometers will be issued for each section of the nation. These barometers may be obtained as soon as they are available upon application to the ELECTRICAL WORLD.

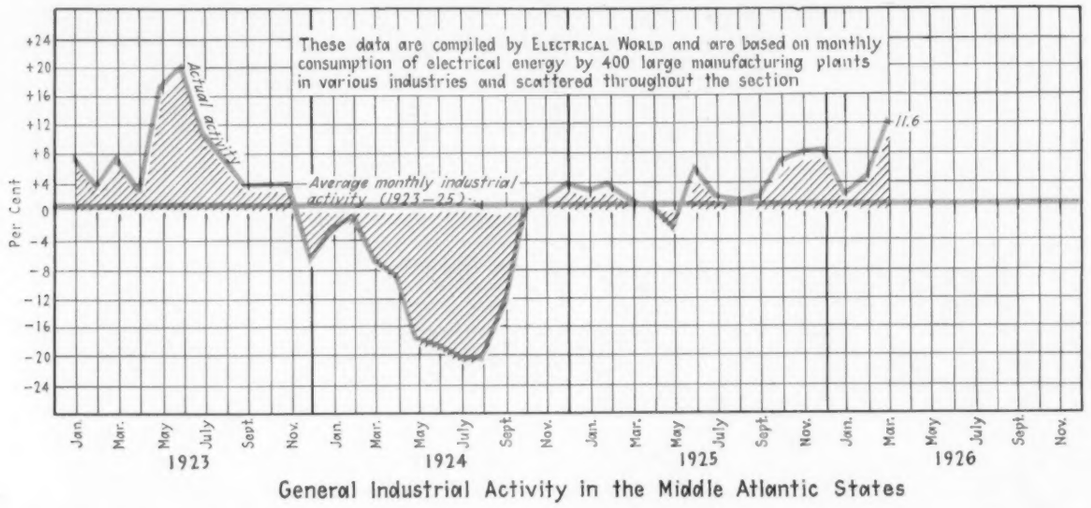
The month of March witnessed a distinct upward trend in the general industrial activity of the Middle Atlantic States, the four chief industries of the section—metals, textiles, transportation and chemicals—all reporting distinct gains over February after the necessary corrections have been made for seasonal variation.

The returns received by the ELECTRICAL WORLD indicate that during March general industrial activity in the Middle Atlantic States was 11.6 per cent above the average monthly industrial activity for the past three years. In February general industry in the Middle Atlantic States was operating at 3.9 per cent and in January at 1.4 per cent above the average monthly.

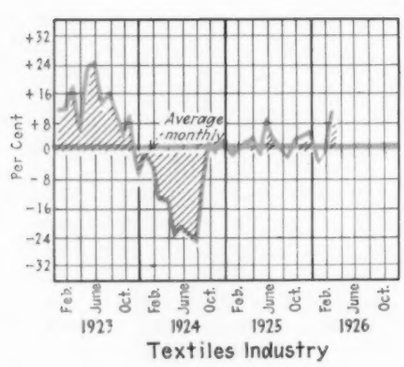
The textile industry in the Middle Atlantic States appears to have increased its activity materially during March. The activity in the textile industry, as measured by the electrical energy consumed by the industry, increased from 3.0 per cent under the average monthly in February to a March activity of 10.6 per cent above the average monthly for the past three years.

The metal industry of the Middle Atlantic States, which group includes both metalliferous and non-metalliferous working plants, reported activity during March of 8.6 per cent above the monthly average, as against 2.1 per cent during February and 0.7 per cent above the average monthly in January. The chemical industry also reported increased activity during March, increasing from 17.9 per cent to 21.0 per cent. The transportation industry, too, was operating at a very high rate, 32.0 per cent.

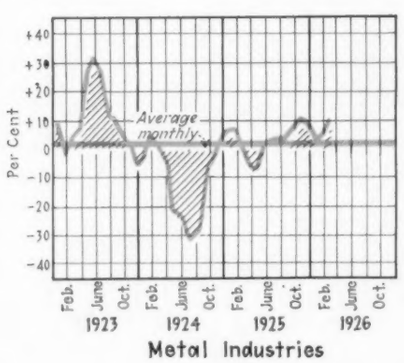
"Electrical World" Barometer of Industrial Activity in the Middle Atlantic States



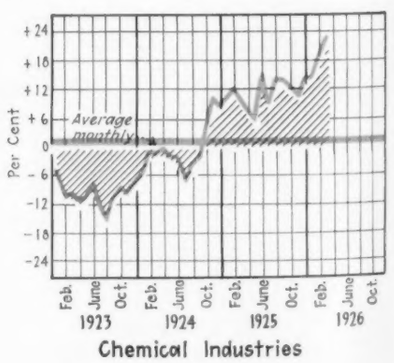
General Industrial Activity in the Middle Atlantic States



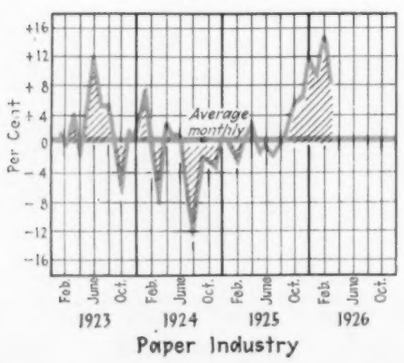
Textiles Industry



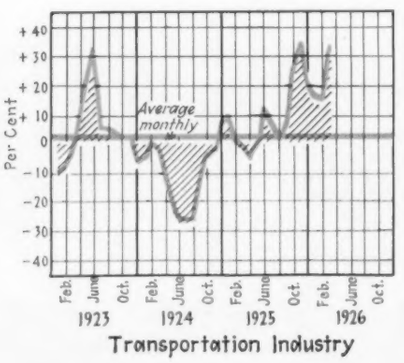
Metal Industries



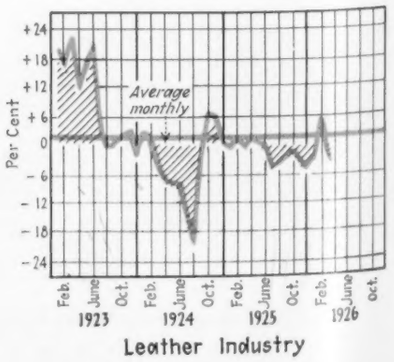
Chemical Industries



Paper Industry

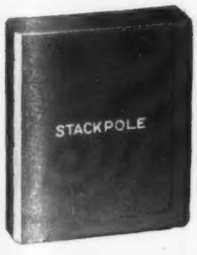


Transportation Industry



Leather Industry

"Indoor Aviation" depends on quality brushes



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With Stackpole Brushes on the job you are always assured of perfect commutation, which in turn means perfect operation of your elevators or other electrical appliances depending on motors for uninterrupted service. Excessive heating, sparking, pitting, chattering with their resultant power loss, inefficient operation and destruction of apparatus are absolutely eliminated with Stackpole Brushes.

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STACKPOLE CARBON COMPANY
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Stackpole carbon brushes

As they Say at PHOENIX KNITTING WORKS

120 I-C Automatic Starters control all D. C. motors driving machinery for Phoenix Knitting Works.

"I-C Direct Current Automatic Starters, Class 7107, have been standard with us for 1½ years. At present we are using 120 of them on individual knitting and dyehouse machine motors. These starters are of the time limit acceleration type, which affords the greatest protection to both motors and machinery.

"I-C starters are easy to install. Their wiring is extremely simple and all connections are easily accessible, resulting in the lowest possible maintenance cost. They soon pay for themselves in repairs saved.

"We have found I-C starting equipment superior to any other we have used. The Industrial Controller Company has given us excellent service in solving difficult control problems."

Charles Bindrich, *Chief Eng., Phoenix Knitting Works, Milwaukee.*

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